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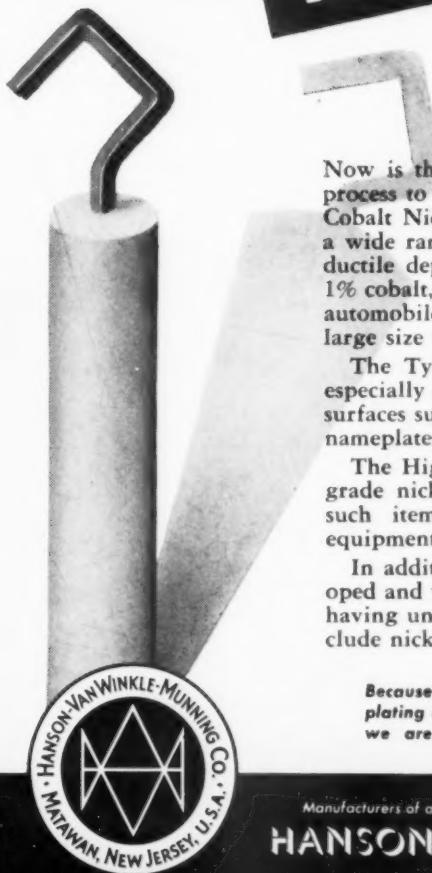
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WARD LEONARD RHEOSTAT

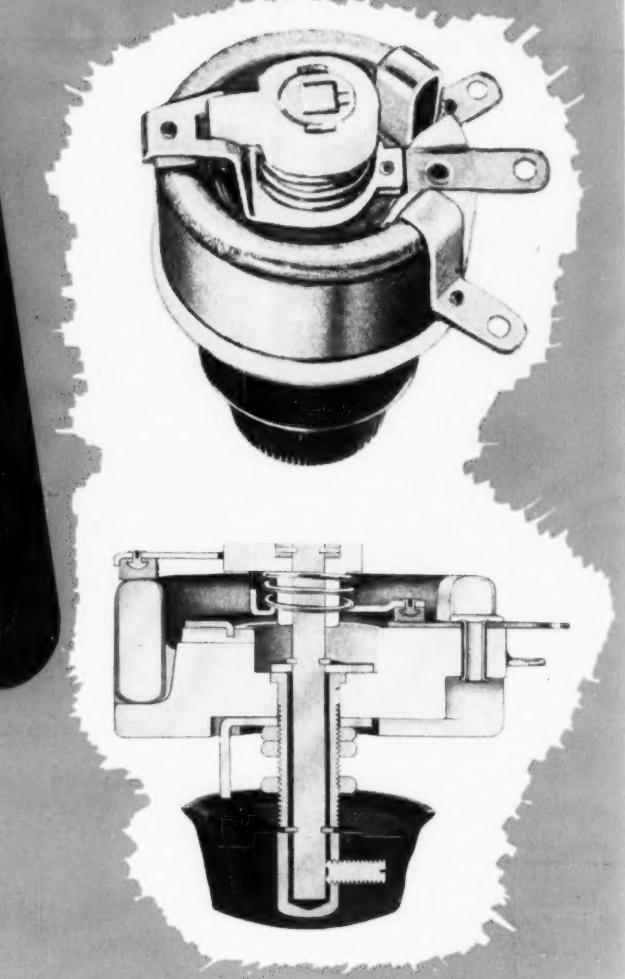
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Reminder—Cadmium Is A Poison

We doubt whether there are more than a handful of platers who haven't been informed, at one time or another, that cadmium is a poison. Yet the disclosures by Dr. L. W. Spolyar, Director of the Industrial Hygiene Division of the Indiana State Board of Health, of a recent death from cadmium poisoning and the circumstances surrounding it leads us to believe that a few more words of caution would not be entirely superfluous.

In this latest case, absorption of cadmium fumes occurred as a result of heating cadmium plated pipe with a blowtorch in order to flange the end. It is interesting to note that a comparable hazard in the plating industry exists in the all too prevalent practice of removing the metal built up on cadmium plating racks by melting it off with a blowtorch. This practice is fraught with danger and should not be permitted unless proper precautions are taken to exhaust all fumes or to provide the worker with a suitable respirator, approved for cadmium.

It so happens that inhalation of cadmium fumes produces no immediate symptoms of poisoning, which results in a tendency to disregard the potential hazard and to continue at the task. Two to four hours later, however, irritation of the nasal passages, a dry, metallic taste, a cough and a headache will appear; eight to twelve hours later the worker will develop chills and the next day will complain of severe chest pains.

These symptoms should be watched for in cases of exposure to cadmium fumes and immediate steps taken to prevent further developments. Although there have been reported to date only nine deaths due to cadmium poisoning in industry, the tremendously expanded usage of cadmium during the last few years warrants the warning that the toxicity of this metal and its compounds should not be ignored or underestimated.

A Sulfate-Chloride Solution for Iron Electroplating and Electroforming

By R. M. SCHAFFERT and BRUCE W. GONSER

Battelle Memorial Institute, Columbus Ohio

CONCLUSION

6. *Pitting.* During the initial experiments on iron surfacing of stereotypes with sulfate-chloride bath, considerable difficulty was encountered with pitting of the deposit. These pits were caused by gas bubbles adhering to the deposit during the plating operation. In electrotyping a few pits are not objectionable, because the printing side of the deposit is the side next to the cathode mold which is not affected by pits, whereas minute pits on the surface of a stereotype will affect the printing quality of the plate.

Pitting can be practically eliminated by agitation of the bath, but this is objectionable because agitation causes rapid oxidation of the iron solution. However, cathodic agitation, such as obtained by a mechanical device, designed to move the cathode rather slowly in a reciprocating manner, will eliminate pitting satisfactorily for most practical purposes without appreciable agitation of the plating solution. In the stereotype surfacing experiments, a vertical reciprocating device with a stroke of 1 in. (25.4 mm.) and a speed of 60 cycles per min. was found to be entirely satisfactory.

Pitting, caused by gas bubble adherence, can be reduced appreciably (but not entirely eliminated) by one or several of the following means:

- a. Treating the iron bath with activated carbon to remove organic impurities.
- b. Occasionally moving the cathode up and down in the bath to wash off gas bubbles.
- c. Addition of 2 to 4 cc./L. of o-cresol sulfonic acid and 0.25 to 0.5 g./L. of duponol "ME." (These two addition agents, used together, produce a smooth, semi-bright deposit.)
- d. Using the lowest permissible plating temperature. (Baths operated at room temperature produced less pitting than heated baths.)

7. *Effect of Composition.* A plain ferrous sulfate solution will ordinarily produce dark, crumbly deposits, except at very low current densities. Addition of a small amount of ammonium chloride to the ferrous sulfate solution permits a considerable increase in current density without causing dark deposits or "burning," but if sufficient ammonium chloride is added to permit a current density of about 100 amp./sq. ft. (10.7 amp./dm.²) without darkening, the deposit obtained is quite brittle, and trouble with peeling and cracking is encountered. If, however, relatively small amounts of both ammonium chloride and ferrous chloride are added to the ferrous sulfate solution, good deposits can be obtained at high current densities without peeling or cracking and with considerably less brittleness.

If ferrous chloride alone is added to the sulfate solution, dark deposits are encountered at the higher current densities. It appears that the ammonium ion is necessary in a ferrous sulfate bath for deposition at high current densities. If the ammonium salt is added in the form of ammonium sulfate, however, peeling and cracking occur at relatively low current densities, making such a bath unusable for electrotyping. It appears, then, that the chloride ion is also

effective to some extent in reducing brittleness and strains in iron deposits. A proper balance in sulfate, chloride, and ammonium proportions will permit current densities up to about 200 amp./sq. ft. (21.5 amp./dm.²) without danger of burning the deposit.

Where relatively low current densities are used, a lower concentration of ammonium chloride will improve ductility of the iron deposit.

Small additions of such compounds as citric, tartaric and lactic acid, dextrose, and gelatin to the sulfate-chloride bath are more or less conducive to such defects as peeling, blistering, and dark deposits. The wetting agent triton NE, even in very minute quantities, is especially damaging in this respect. However, small additions of o-cresol sulfonic acid and the wetting agent duponol ME, used for obtaining smooth deposits, did not cause peeling.

8. *Stability of the Bath.* Test baths used in the laboratory were found to change very little in composition over a period of months. The average figures for anode and cathode efficiencies, 101% and 97%, respectively, indicate a gradual increase in iron content under operating conditions. This increase is somewhat more than offset by dragon and ferric hydroxide precipitation, which is more rapid during operation. Occasional reducing treatments and acid and iron filings are beneficial. Such treatments will increase the iron content somewhat, but not enough to have noticeable effect on plating results. The gradual decrease in iron content, caused by hydroxide precipitation, together with increase during reduction, results in a fairly constant average iron content over a period of time.

The pH of the bath decreases at a rather slow rate under periodic operating and standing conditions, so that occasional additions of ammonium hydroxide are required. A test bath used periodically, was found to decrease in pH from 6.2 to 4.0 during an interval of two months.

A 280-gallon (1160 L.) sulfate-chloride bath, installed in an electrolyte foundry for use in surfacing stereotypes, has been in use for over a year. It has been reported that the bath is giving better results than when freshly prepared, although no adjustments in composition have been made to date. pH adjustments were required every two months and the bath was given a reducing treatment about every four months.

(e) Character of Deposits.

Since a considerable amount of the experimental work was concerned with electrotyping applications, interest was centered around the properties of the electrolytic iron itself, free of any basis material. In this connection ductility was of considerable importance.

1. *Ductility.* Electrodeposited iron is usually brittle. In fact, of the 125 iron baths investigated, none was found to produce ductile deposits in the sense that the deposit, after removal from the basis material, could be bent appreciably without breaking. The deposits obtained with the sulfate-chloride solution were less brittle than those from any o-

the other baths tried, but were not ductile enough to withstand appreciable bending. However, deposits up to 0.005 in. (0.127 mm.), reinforced with an equivalent thickness of copper, are ductile enough to withstand curving and finishing operations encountered in electrotyping plants without annealing. These deposits can be rendered quite ductile by short-period annealing in the range 900° to 1400° F. (482° to 760° C.).

Brittleness in electrolytic iron is often attributed to absorption or inclusion of hydrogen during deposition. This theory has been disputed by Muller, Heuer, and Witnes⁸ who suggest that brittleness is caused by the inclusion of traces of oxides and basic compounds which affect development of crystal formation as iron is deposited. These authors reported that small additions of AlCl₃, BeCl₂ or CrCl₃ to a ferrous chloride bath resulted in soft deposits.

In the present work, it was found that additions of AlCl₃ in amounts ranging from 0.5 g./L. to 4 g./L. produced no appreciable effect on either hardness or ductility of the deposits.

2. Effect of Annealing. A test sample was prepared, as before, except that a 0.020 in. (0.5 mm.) iron plate was made at a temperature of 110° F. (43° C.), a pH of 5.73, and a current density of 60 amp./sq. ft. (6.4 amp./dm.²).

The stripped deposit was cut into small samples which were annealed in a furnace for 20 minutes at temperatures ranging from 900° F. (482° C.) to 1400° F. (760° C.). The samples were then sectioned, mounted in bakelite and polished for micro-hardness tests. The hardness measurements were taken over the cross-section surface of the deposits. Results are shown in Table II.

TABLE II.—EFFECT OF ANNEALING TEMPERATURE ON HARDNESS OF IRON DEPOSIT

Specimen	Annealing Treatment	Knoop Hardness No.*
A	None	390.0
B	20 min. at 900° F. (482° C.)	374.2
C	20 min. at 1,000° F. (538° C.)	316.6
D	20 min. at 1,200° F. (649° C.)	181.5
E	20 min. at 1,400° F. (760° C.)	102.3

* Knoop numbers are approximately equivalent to Brinell numbers.



Fig. 4. Iron deposit as plated. Specimen A (Nital etch). x250.

Sulfate-chloride bath, iron deposit, 0.020 in. (0.5 mm.). C.D., 60 amp./sq. ft. (6.4 amp./dm.²). Temp., 100° F. (38° C.). pH, 5.73.

These iron deposits can be rendered quite ductile by annealing for relatively short periods at temperatures above 900° F. (482° C.). The required time for annealing to a bendable condition was less for higher temperatures, being about 20 min. at 1200° F. (649° C.) and about 40 min. at 900° F. (482° C.) for a deposit 0.020 in. (0.5 mm.) thick.

Photomicrographs of the specimens listed in Table II, showing the grain structure of the iron deposit as plated and after the various annealing treatments, are given in Fig. 4, 5, 6, 7, and 8.

Applications of the Sulfate-Chloride Iron Bath

(a) Electrotyping

The sulfate-chloride bath was developed primarily for electrotyping. In this connection it has been used successfully (1) as a substitute for nickel in nickeltypes, (2) to replace up to 70% of the copper in electrotypes, and (3) to replace copper and nickel entirely in making flat-plate electrotypes.

In order to plate iron successfully on either graphited wax molds or dichromated lead molds, it is necessary to first cover the mold with a very light flash of some other metal. This can be done in one of the following ways:

- "Apply" acid copper sulfate and iron filings to give a thin coating of copper.
- Flash with copper in a copper electrotyping bath.
- Silver the mold by chemical reduction methods with silver spray equipment.
- Flash with nickel in a nickel-electrotyping bath.

In substituting iron for nickel and in partial substitution for copper, the iron deposition is followed by a supporting layer of copper. Since adherent copper cannot be plated directly on iron in an acid bath, it is necessary to treat the iron surface prior to copper plating by one of the following methods:

- Immerse the iron-covered mold in an arsenic dip solution for about 10 seconds.

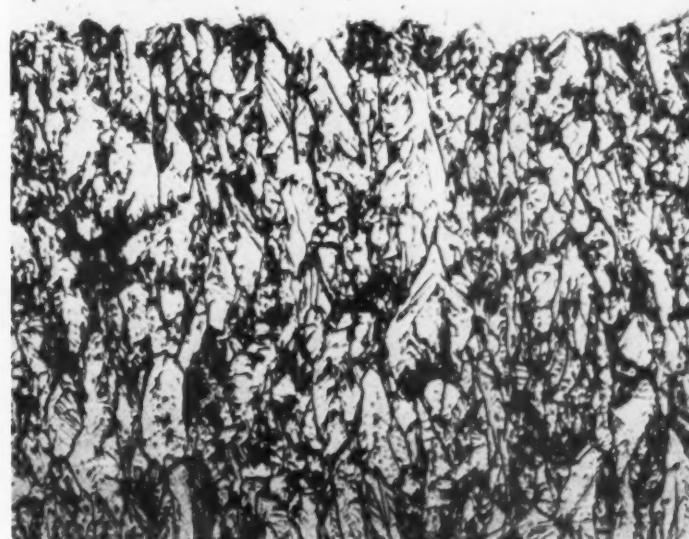


Fig. 5. Iron deposit after 20 min. at 900° F. (482° C.). Specimen B. (Nital etch) x250.

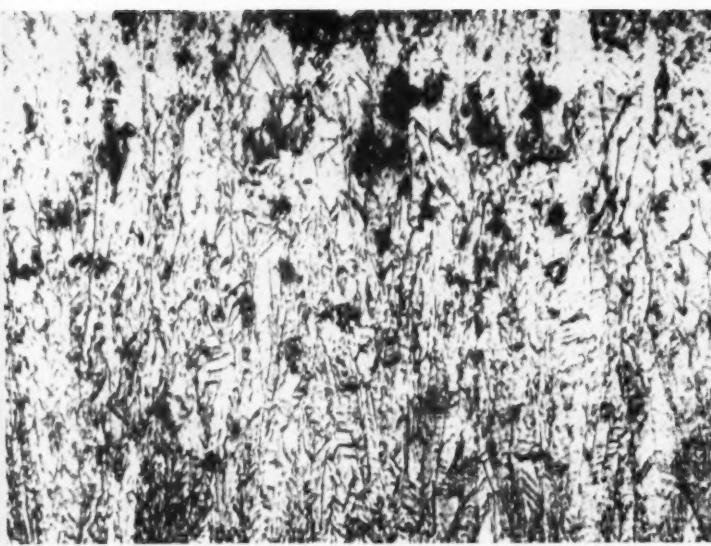


Fig. 6. Iron deposit after 20 min. at 1,000° F (538° C). Specimen C. (Nital etch) x250.

b. Electroplate the iron with a flash of copper in a cyanide copper bath, or with a flash of nickel in a nickel plating bath.

The arsenic dip method was developed by Lamb and Blum and has been described in their publication.¹⁷ It has been used successfully at the U. S. Government Printing Office and at the Capital City Printing Plate Company, Des Moines, Iowa.

In substituting iron for nickel in nickelotypes, 0.001 in. (0.025 mm.) of iron is plated on the mold, and followed by the usual thickness of copper.

In substituting for copper in copper electrotypes, 0.025 in. (0.061 mm.) to 0.004 in. (0.098 mm.) of iron is plated on the mold and this is followed by enough copper to give a total shell thickness of 0.006 in. to 0.007 in. (0.15 to 0.17 mm.). The usual thickness of the copper shell used for electrotypes is 0.008 in. to 0.009 in. (0.20 to 0.22 mm.). However, since iron gives added strength to the shell, this thickness can be reduced to a total of 0.006 in. (0.15 mm.) when iron is used.

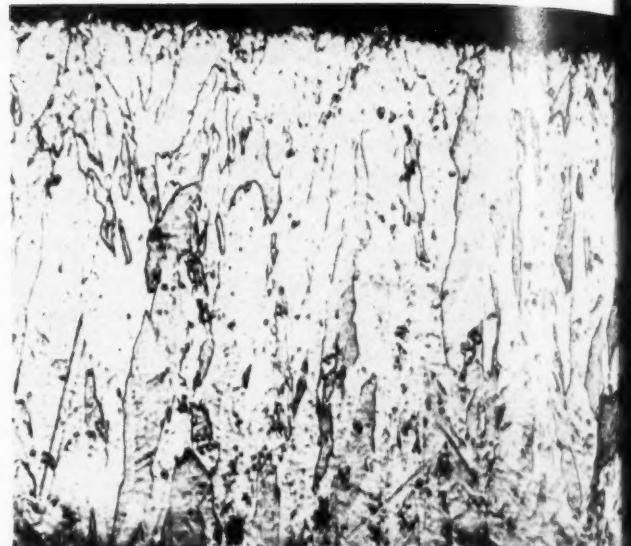


Fig. 7. Iron deposit after 20 min. at 1,200° F (649° C). Specimen D. (Nital etch) x250.

Complete substitution of both copper and nickel in flat plate electrotypes is accomplished in the following manner: Iron is plated on the mold, as previously described, to a thickness of 0.005 in. (0.11 mm.). This is followed by plating 0.005 in. to 0.006 in. of lead (as from a fluoborate bath) over the iron deposit. The shell is then complete and ready for subsequent electrotyping operations.

The purpose of the lead deposit is to support the iron shell, so that the shell can be removed from the mold without danger of breakage.

Attempts to curve these copperless electrotypes by standard foundry methods have not been successful to date because of checking and surface cracks resulting from stretching. However, since a large volume of flat electrotypes is used, these copper-less, nickel-less plates can be used in considerable quantity for many applications, even though curving is not practical.

(b) Stereotype Surfacing

Iron surfacing of stereotypes is accomplished in the following manner:

- Cleaning.* The stereotype surface is first scrubbed with a solution of caustic soda, 2 to 4 oz./gal. (15 to 30 g./L.) using a soft-haired brush, to remove dirt and grease. (A solution of sodium cyanide or trisodium phosphate can be used also.) This is followed by rinsing and then cleaning as anode for about $\frac{1}{2}$ min. at 6 volts in a warm (120° F.) (49° C.) salt bath, consisting of 8 oz./gal. (60 g./L.) sodium chloride and 1 oz./gal. (7.5 g./L.) ammonium chloride. After the anodic treatment the stereotype is scrubbed and rinsed at the same time until the dark surface smudge is removed.

- Electroplating.* After cleaning, the stereotype is placed in the iron bath and plated with 0.00075 in. to 0.001 in. (0.019 to 0.025 mm.) of iron. To avoid pitting, a vertical reciprocating motion of the stereotype while plating is recommended. Usually pitting can be sufficiently retarded by lifting the stereotype occasionally during the plating period and "swishing" up and down to remove clinging gas bubbles.

(Concluded on page 678)



Fig. 8. Iron deposit after 20 min. at 1,400° F (760° C). Specimen E. (Nital etch) x250.

Metallizing Non-Conductors

By SAMUEL WEIN

New York, N. Y.

PART III

Chemical Reduction Films—Silver

THE most successful commercial method for depositing metals on non-conducting surfaces is the so-called "silvering process." This is because so much effort has been put to it by many workers, because the details have been carefully worked out, and, last but not the very least, because it gives rise to the best and most consistent results.

Silvering processes serve one other purpose, *i.e.*, for producing mirrors, and it is this very film that is the subject of discussion in this group of metallic films.

Metallic films on glass for mirror use were formerly made of an amalgam of mercury and tin. Such mirrors have been entirely supplanted by films of silver, because mercury vapors, present during the preparation of the amalgam, are very injurious to the health of the workmen. However, those readers who are interested in investigating the preparation of amalgam mirrors will find details in the *Scientific American Encyclopedia of Formulas*, edited by Albert H. Hopkins and published by Munn & Co., in New York City.

It is interesting to note that the process of silvering glass was first practiced in or about 1840, the same year that Elkington introduced the electroplating of silver. The actual discovery of the deposition of films of silver on glass was made by Von Liebig in 1835, who found that by heating acetaldehyde with an ammoniacal solution of silver nitrate in a glass vessel, a brilliant deposit of metallic silver (mirror) was formed on the surface of the glass.

Since that time, hardly a year passes by without some new silvering process being developed or a patent being granted for an improved method for making mirrors.

A search of the technical and patent literature on silvering processes discloses a vast number of papers on the subject in a wide variety of languages. The processes usually discussed involve the use of cold as well as hot solutions. No book of formulas seems complete without its recipes for silvering glass, and, so many different ones are usually given that the investigator is indeed bewildered. Silverman and Neckerman, as well as Silverman and Howe conducted a systematic study of the methods of precipitation of silver in mirror form, and their work still stands as the most complete review of the subject in the literature.

A typical sequence of operations, after the plastic surface has been suitably roughened, will be as follows:

1. The work is cleaned by dipping in a mild alkaline cleaner followed by a thorough rinse, a nitric acid dip and another thorough rinse.

2. The work is dipped into a slurry of stannous chloride in water and rinsed in clear water.

3. The work is treated in the silvering bath. (This may be done in a trough or in a tumbling barrel, depending on the nature of the work.)

The stannous chloride treatment is sometimes omitted, though most platers of plastics will use it, for it appears that an extremely low concentration of tin ions on the surface of the work, such as would be brought about by dipping and rinsing as described, is conducive to the rapid and uniform reduction of the silver salt.

The adhesion of the thin silver film, produced by these reduction methods, to the plastic surface, no doubt brought about by molecular forces, is, in many cases quite strong, but the stresses and strains induced in it by subsequent electrodeposition of other metals may cause the bond to fail in certain applications where the subsequent electrodeposit does not completely surround the work mechanically. For this reason, methods have been devised to obtain firmer anchorage and bonding of the initial silver surface to the plastic object. These methods involve either chemical roughening (swelling or etching) or mechanical roughening (sand blasting, rolling, pumicing) before the silver coating is applied.

Several chemical roughening methods have been proposed and patented. The essential point is that they assert a dissolving action on the plastic of which the work is made. The common plastics that are encountered are the phenol-formaldehydes (Bakelite, Catalin, etc.); the cellulose esters (acetates, nitrates, butyrates, etc.); the urea-formaldehyde (Beetle, etc.).

For cellulose esters, for example, an acetone solution may be used either alone or in conjunction with other solvents. A solution containing potassium bichromate and sulphuric acid has been patented for the same purpose. Solutions of hydroquinone have also been suggested for swelling urea and casein plastics, though in this case it may be a question of simple absorption on the plastic surface, the residual hydroquinone permitting easy reduction of the silver. Occasionally, if care is used, an ordinary bright dip will also be found good for swelling plastic surfaces and strong caustic alkalies are sometimes utilized for the same purpose. Experiment can prove which method is particularly suited to an individual case.

The plastic can be mechanically roughened, if desired, by either sand blasting or sand rolling or pumicing. In any case, too much roughening will tend to give rise to that unwanted plating effect known as "orange peel."

Chemicals and Apparatus

All chemicals used in the preparation of silvering solutions must be of the highest purity, and technically described as "chemically pure" (C.P.). Some manufacturers of chemicals produce a grade termed "technically pure," and this too may be used with comparable results. The difference in purity is too small in many cases to warrant discussion, but the difference in price between the chemically pure and technically pure is certainly worthy of serious consideration. In order to prove this point, it is well to buy a small quantity of both the chemically and technically pure varieties, to test both in a formulation and to compare the results obtained with both compounds.

In some of the formulas reference is had to "pure grain alcohol." This is difficult to obtain at the present time because of Government restrictions, and, as a result, ordinary commercial rubbing alcohol has been used by a number of silvering shops with gratifying results. Alcohol denatured by the addition of wood alcohol 1 part to 20 parts of grain may be used to replace the grain alcohol, corresponding to special denaturing formula 3A of the Bureau of Internal Revenue.

All solutions require distilled water, and not tap or so-called "mineral water," since contaminating chemicals such as free chlorides, iron, etc., usually found in tap and mineral water, will precipitate the silver from solution, and so nullify the effects of silvering. Distilled water may be obtained from local stores in 5-gallon glass bottles, or from firms actually engaged in such business, and their names and addresses are to be found in local telephone directories. Those who will do much silvering, may find it desirable to produce their own distilled water, or to purify their tap water by means of ion-exchange apparatus, which is much cheaper. Some workers have been in the habit of triple distilling the water, in order to make certain that the water is absolutely free from contaminating chlorides, iron, etc.

The stock solutions are usually kept in wide mouthed brown bottles and in a dark cool place, so as to avoid possible effects of light and an increase in temperature on the silver compound. The preparation of these compounds is usually carried out in round-bottomed or balloon-shaped flasks such as is found in chemical laboratories. It is obvious, of course, that all glassware must be clean. This cleaning process may be carried on with a dilute nitric acid solution or a potassium dichromate solution, followed by washing in running water and then in distilled water. Metal vessels are not recommended, because these will be affected by the silvering compounds. If large quantities

ties of solutions are to be prepared, earthenware or enamelware containers may be used. Wooden vessels may be used if the interior is first paraffined to eliminate possible contamination from the chemicals previously in the vessel.

Caution: Great care must be exercised in handling alkaline silvering solutions, as these are very sensitive, when dry, to mechanical handling, *i.e.*, they are explosive. No violent shaking or stirring should, therefore, be resorted to. In order to avoid such explosions, it is well to keep all bottles corked and carefully cleaned. The excess-wash waters, etc., containing silver may be kept in a large container to which is added sufficient hydrochloric acid to render it acid.

The preparation of the silvering solution is simple. It is usually carried out by adding ammonia in small quantities to the silver nitrate solution, the addition being continued until the precipitate first formed is just redissolved. A slight excess of ammonia is recommended, this preventing deposition of silver. Too little ammonia will result in an excess of precipitated silver oxide which is not recommended, and this must be removed by filtration.

The ammonia recommended and found to give the best results is the concentrated variety (specific gravity 0.88 to 0.90). When this solution is first added to the silver solution, a precipitate forms at once, and, as the ammonia is added, with continued stirring, the precipitate will be seen to dissolve and the solution will become clear. A slight excess of ammonia should be added, as previously mentioned, in order to avoid precipitation of silver oxide.

Cleaning the Surface

The customary procedure in cleaning the surface is to lay the glass or other material on a wood tray, slightly larger than the piece to be coated. Some workers prefer to coat the wood with a film of paraffin. This tray may be used for cleaning as well. The process of cleaning is simple, the first step being to wash the article in running water, following by a rinse with alcohol, ether or other suitable solvent. The next step is to clean the surface with a dilute solution of nitric acid. This is done by means of a cotton swab formed on a wooden stick or a glass spatula or rod dipped in the nitric acid solution and rubbed over the surface to be silvered. Care must be taken to avoid scratching the surface with the harder portion of the glass rod or stick. After this swabbing has been done, the surface of the glass is washed with running water to remove the free acid, and is then given a distilled water rinse. The material so treated is now ready for the silvering process.

Some workers prefer to treat the surface of the material with a dilute solution of potassium hydroxide, followed by washing in running water. Other workers use French chalk on the surface of the item after treatment with acid and alkali, thereafter washing with running water.

Once proper cleaning of the surface has been performed, it is now treated with a saturated solution of stannous chloride,

washed with water, and the surface is finally ready for the silvering process.

The surface of the pieces to be silvered must never be touched by the hand, as the natural oils in the fingers will be deposited on the surface, and the cleaning process will, of necessity, have to be repeated, since silvering at the point where the finger marks exist will not be satisfactory.

Among the many compounds that have been tried or recommended as reducing agents, the following have been found to work satisfactorily:

- (a) Loaf sugar (or granulated), milk sugar, cane sugar and glucose.
- (b) Formaldehyde.
- (c) Sodium or potassium tartrate, sodium-potassium tartrate (Rochelle salts) and tartaric acid.

If cane sugar is used it is invariably accompanied by a small amount of nitric acid which inverts the cane sugar to dextrose and levulose.

Citric acid, dextrin, tannic acid and stannous chloride will reduce the silver but will not result in the formation of a mirror. In all of the processes one of the solutions is prepared by dissolving silver nitrate in water, precipitating the hydroxide by means of ammonia or other alkaline hydroxide, and then redissolving the precipitate by the addition of an excess of the alkali.

In order to obtain a uniform and adherent silver film on glass, it is essential that the glass be given a preliminary treatment with tin chloride. This fact is well established and is used wherever silvering is carried on. This process is termed "priming," or sensitizing the surface prior to application of the silvering solution. The recommended concentration varies in different formulations, and may be anywhere from 5 to 15% of stannous chloride in water.

The method of application of the priming solution is either by simple immersion, followed by very thorough rinsing, or, by gentle swabbing with a piece of cotton wool soaked in the solution. After rinsing, the glass is immediately transferred to the silvering bath. It is essential to rinse away any adhering stannous chloride solution, otherwise the subsequent silver deposit is liable to be mottled in appearance. There need be no fear of removing all the stannous chloride by too thorough rinsing. Results indicate that this is strongly absorbed at the surface.

The function of the stannous chloride has been variously interpreted. There is no doubt that it has a double function, the insurance of good silver deposit, and also improved adhesion. It has been suggested by Fafet that in the case of glass, a silicate of tin is formed at the surface. This suggestion obviously does not explain the equal effectiveness of the stannous chloride as a priming agent in the silvering of materials other than glass.

Namias concluded that tin silicate was formed on the surface of the glass thereby causing more rapid reduction and better adhesion of the film. Baum stated that the use of stannous chloride in making silver mirrors probably caused fixation of the tin ions by exchange with some materials in the

glass, and that these then acted catalytically and as nuclei in causing the deposition of silver. These conclusions seem unlikely in view of the work by Macchia. In this work, celluloid, wood and galalith were coated with chemically deposited silver with and without previous treatment with tin. The time required for the mirror to appear was noted and the adhesion of the film was determined by means of a specially constructed sclerometer. The results showed that immersion of the samples before silvering for 20 seconds in a dilute solution of stannous chloride greatly decreased the time of silvering and greatly increased the adhesion of the film. Inasmuch as the effect of the tin chloride was the same on wood and celluloid as it was on glass, the theory of the formation of tin silicate was disproved.

In addition to the tin chloride solution (concentration 1 part stannous chloride in 1500 parts water) experiments were conducted with a 5 percent solution of tin chloride made alkaline with sodium hydroxide. The results obtained were the same as with the dilute tin chloride solution.

The action of tin chloride is considered by Macchia to be due to its hydrolysis in aqueous solution, increasing with dilution to the colloidal hydrosol of tin hydroxide, which on coming in contact with the surface to be silvered is converted rapidly to the firmly adherent hydrogel. If this is the case, there should be other substances which would accomplish the same results.

Von Wartenberg attributes the accelerating action of 0.1% stannous chloride solution to the adsorption of a stannous oxide solution upon the glass surface. This facilitates the adsorption and reduction of silver oxide. He found that there are other colloids that act similarly to tin chloride. Moreover, an accelerating effect of the same nature was obtained in the deposition of gold. The series of compounds, indicating the degree of acceleration of silvering by various substances with which tests were made, is listed below:

	Concentration Percentage
Stannous chloride	0.1
Titanium oxide	0.1
Stannic oxide (alkaline)	0.1
Zirconium oxide	0.2
Thorium oxide	0.1
Thorium nitrate	0.1
Zirconium nitrate	0.004
Methylene blue	0.5
Silica	2.0
Stannic oxide (acid)	0.3
Titanium chloride	0.02
(POOREST)	

It is obvious there is room for further study of this interesting phenomenon. Certainly if there is any exchange of ions with materials from the glass, then different types of glass surfaces should cause some variation in the effect. Experiment along these lines have been initiated by some investigators with the aim of determining the variation in silvering time and adhesion of the silver film when the surfaces to be silvered are fire polished, freshly fractured or optically polished.

Smith treats the cleaned glass surface with a 0.1% solution of freshly prepared acid or an alkaline solution of lead acetate, stannous chloride or borium nitrate and, after washing, thereafter silvers by any of the conventional silvering methods.

Waits treats wood with a solution of silver nitrate, thereafter it is treated with a solution of iron sulphate or tin chloride.

Silver films may be "whitened" according to Lenoir by treatment with a solution of:

Mercuric cyanide	800 parts
Potassium cyanide	250 "
Water	5000 "

This solution is diluted with 10 times its volume of water for use. As soon as the solution is poured onto the silvered surface the brilliant white film will form immediately.

Mercury acetate or chloride according to Bourre may be used to wash the glass surface prior to silvering in order to give the deposited film a more brilliant white color.

In order to accelerate the precipitation of the silver on the glass, use is made of a wooden table into which steam pipes are fixed so that it might be kept at a given temperature. This appears to be first described by LaVal.

Silvering

The process of forming silver films on a given surface as in the case of cleaning is equally simple. The first thing to remember is that the material to be coated must not be touched by the hands after it has been cleaned and washed. The next step is to properly mix the silvering compounds as the formula recommends. Mixing should be done quickly, and the combined solution is now poured over the cleaned pieces to be coated. If a thicker film of silver is desired, the silvering process may be repeated as often as is found necessary to build up the necessary film of silver. This done, the excess solution is now poured or drained off into a receiving vessel, and made acid. The work is then washed with running water, and is ready for copper plating, if that is the next step.

Brashear Process

The Brashear process is one in which the silvering solution contains potassium hydroxide as well as ammonium hydroxide with sugar as the reducing agent, and, is made up of:

The Reducing Solution

Water	33.81 oz.
Sugar	3.17 "
Nitric acid (sp. gr. 1.42)	0.14 "

In the early work with the use of this process, rock candy was specified. Tablet sugar, the purest sugar which can be readily purchased at the local grocery store, is recommended. A good grade of granulated sugar can be used with satisfactory results.

The reducing solution is boiled for five minutes and allowed to cool before using. It is preferably prepared in large quantity, as it does not deteriorate and is said to improve with age. If it is to be stored, 175 ml. of grain alcohol is added to the above amount, after cooling, as a preservative. The

boiling may be omitted if the reducing solution is prepared one or two weeks in advance of use.

The Silver Solution

"A" Water	13.52 oz.
Silver nitrate	0.71 "
Potassium hydroxide	0.35 "
"B" Water	1.01 "
Silver nitrate	0.07 "

When preparing solution "A," the chemicals are added in the order given. The addition of the potassium hydroxide produces a large amount of precipitate, which is later to be redissolved by the addition of ammonium hydroxide. If the specific gravity of the ammonium hydroxide is 0.90, approximately 50 ml. will be required for the amount of solution given in the formula. This quantity of silver nitrate solution will suffice for approximately 125 square inches of surface although a greater amount of solution may be used if a particularly heavy film is desired. The silver nitrate and reducing solution are mixed immediately before application to the surface to be silvered. One part by volume of reducing solution is mixed with four parts of silver nitrate solution.

Majumdar in making copper master shells by plating the original wax recordings, finds that ordinary silvering methods cannot be applied here because of surface tension existing between the deposited metal and the wax surface itself. This he overcomes by treating the surface with a "wetting agent" commercially known as "Perminol E. M. L." of which 50 cc. is used to the liter of water. The wetting agent solution is poured over the wax surface which is then washed with running water. Thereafter it is washed with a 4% stannous chloride solution, and then thoroughly rinsed with water. Such a surface is best suited for silvering. The following solution has been successfully used:

"A" Glucose	25 g.
Tartaric acid	3 "
Water	250 cc.
Boil for 10 minutes.	
"B" Silver nitrate	20 g.
Ammonium nitrate	30 "
Water	500 cc.
"C" Sodium hydroxide	50 g.
Water	500 cc.

Equal volumes of solutions "A," "B" and "C" are mixed and poured onto the treated wax surface. In about two minutes the silver film forms on the wax surface. The best temperature of the solution is between 18° and 22° C. This silvered surface may then be copper plated from an acid copper plating bath.

Freund deposits metals on cellulose ester sheets by first treating with a solution of:

Sulphuric acid (66° Bé)	100 cc.
Potassium dichromate (saturated solution)	15 "
Water	25-30 "

The material is now washed with running water and silvered with the following:

"A" Silver nitrate	4 g.
Water	100 cc.
"B" Ammonia (sp. gr. 0.88-0.9)	8.3 "
Water	100 "

"C" Potassium hydroxide	4 g.
Water	100 cc.
"D" Rock candy	3.5 g.
Alcohol	12 cc.
Nitric acid (sp. gr. 1.42)	10 drops
Water	200 cc.

Solution "D" should be boiled for about 10 minutes, and, after cooling, diluted with water to replace one-half of the solution loss caused by boiling. An additional 10 drops of acid is added.

In use, equal volumes of the four solutions are thoroughly mixed together and the resulting solution immediately poured over the material to be treated.

Dupuis forms a lacquer of Lithopone	75 g.
Nitrocellulose lacquer	375 "

to the foregoing is now added Thinner 280 g. preferably only a part of the thinner is added so as to facilitate solution. Thereafter add:

Powdered copper	65 g.
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slowly and, finally, the balance of the thinner is added and the entire mass is thoroughly mixed. This compound does not keep well, and it is suggested by the inventor that it be prepared as needed. This "paint" is applied to the surface by means of a spray gun and allowed to dry. Subsequently it is "flashed" with a silver film by dipping first in a solution made up of:

Pyrogallic acid	90 g.
Acetic acid	10 "
Water	1 L.

and then in the silvering solution, made up of:

Silver nitrate	20 g.
Ammonia	30 centiliters
Water	1 L.
Mercure chloride	2 g.

The silvered surface is now rinsed and it is ready for copper plating from an acid copper bath.

Pasnit recommends the following silvering solution for use with wax surfaces, as used in the electrolytizing industry:

Thio-alcohol	1 1/4 drops
Ethyl alcohol	7 ml.

The foregoing is added to:	
Silver nitrate	1.43 g.
Water	20 ml.
Ammonia (10%)	30 drops

The reducing agent is made up of:	
Triethanolamine (10%)	37 drops
Formaldehyde	38 "
Water	64 ml.

This latter solution is filtered and added to the silvering solution immediately before application.

Silvering Methyl Methacrylate

Herewith follows a laboratory method, as developed by Bartol, for forming silver films on Plexiglas (methyl-methacrylate). This method has never been worked on a large scale but there is no reason why it should not work as well in production. The formula as worked out with respect to proportions is sufficient to cover an active area of 10" x 16" (one side).

Four solutions are required for this method. These are as follows:

Solution A: For the pretreatment of the Plexiglas.

Sodium hydroxide (reagent grade) 350 grams per liter (or 2.92 pounds per gallon) of water.

This solution must be made up in and kept in a clean glass container. It may be kept and used as long as it does not become badly discolored or turbid. It is suggested that only enough of this solution be prepared to fill the pretreatment tank and that it be replaced by fresh solution or very carefully filtered through asbestos whenever it becomes turbid or yellow. Contamination of this solution by iron or iron salts must be avoided.

Solution B—The reducing solution

Cane Sugar (granulated) 90 g.
Nitric acid (C.P. Reagent grade) 4 cc.
Ethyl alcohol (grain alcohol) 95% 175 "
Water (distilled) to make 1000 "

Prepare this solution in a clean glass container as follows:

Dissolve the cane sugar in 500 cc. of distilled water. Add the nitric acid slowly with stirring. Then add the alcohol and dilute with distilled water to make up the total volume to 1000 cc.

Caution—This solution must stand at room temperature for at least one week before it is ready for use.

Solution C—The silver solution—to be made up in three parts.

Part I—Silver nitrate (Reagent grade) 100 g.
Distilled water 1000 cc.
Make up and store in a clean brown glass bottle.

Part II—Sodium hydroxide (Reagent grade) 100 g.
Distilled water 1000 cc.
Make up and store in a clean glass bottle.

Part III—Ammonium hydroxide (C.P. Reagent grade —28%) 400 cc.
Distilled water 600 "
Make up and store in a clean glass bottle.

All silvering solutions are to be kept at room temperature (70-80° F.) and the silvering operation is to be conducted at the same temperature. "Hot table" silvering is not suitable for Plexiglas.

These solutions may be stored indefinitely at room temperature as long as the bottles are kept well stoppered and out of direct sunlight.

Fill the pretreatment tank with enough of Solution A to entirely immerse the pieces of Plexiglas which are to be silvered.

Carefully place the pieces of Plexiglas, in the pretreatment tank. Carefully examine the pieces after they are placed in the tank to make sure that no air bubbles have been trapped in contact with the surface of the Plexiglas. Force the Plexiglas to remain below the surface of the solution by weight-

ing down with a heavy piece of clean glass or a clean bottle filled with sand. These pieces are to be left in this solution for 24 hours.

After the Plexiglas has been immersed in Solution A for 24 hours, proceed with the following operations.

Determine approximately the amount of liquid required to cover the pieces in the silvering tray to a depth of $\frac{1}{4}$ ".

Prepare three times this amount of Solution C, for each piece of work to be silvered, by adding 50 parts of II and 40 parts of III to 1250 parts of distilled water. To this mixture slowly add, with constant stirring, Solution I (Approximately 150 parts of I will be required). It is desired to obtain in the end a clear solution containing a very small amount of light brown precipitate. If a permanent black precipitate is formed it is best to start over again with fresh solutions. If a permanent light brown precipitate is formed before 150 parts of I have been added, add an additional 1 or 2 parts of III and proceed with the addition of I until at least 150 parts (and not more than 170 parts) of I have been added and a clear solution with a very small amount of light brown precipitate is obtained.

Caution: This mixture must not be kept from one day to the next.

Measure out the quantity of this solution (C) required for one application. For each 20 cc. of Solution C, 1 cc. of Solution B is required. Measure out the proper amount of B for one application.

Take a piece of Plexiglas out of the pretreatment tank (always using rubber gloves). Rinse thoroughly under clean running tap water. Follow this by a single rinse of distilled water and place carefully in the silvering tray. Secure piece in tray by one of the methods previously outlined. Rinse again with distilled water. Always keep an unbroken film of water or silvering solution on the surface of this piece which is to be silvered.

Immediately mix the proportions of Solutions B and C as measured out in F and pour this over the work in the silvering tray.

Rock the silvering tray so that the solution travels all the way across the piece of Plexiglas. Continue this rocking, as the deposition of silver progresses, until the solution has become colorless and the flocculent grey silver precipitate has coagulated. Immediately pour this spent solution off into a container reserved for this purpose, in which has been placed 100 cc. of Solution D per 1500 cc. of Solution C. Rinse off, into this container, the remaining precipitate with distilled water. (See method of silver recovery). Rinse off the mirror under rapidly running (not a jet) tap water to dislodge and remove small particles of precipitate. Rinse again with distilled water.

Immediately pour over the mirror a second mixture of Solutions B and C measured out as above. Proceed as before except that before the final rinse of distilled water the mirror should be carefully swabbed with a bit of clean cotton while rinsing with the tap water. Rinse again with distilled water.

Immediately pour over the mirror a third

portion of Solutions B and C. Proceed again as above.

Remove the mirror from the tray and rinse both sides of the mirror under running tap water for 2 or 3 minutes. Follow this with a rinse of distilled water being careful to prevent any tap water from again coming in contact with either side of the mirror.

Place the mirror on edge in a rack to dry. The mirrors should dry at room temperature (or a temperature not exceeding 35° C.) for 48 hours. *Do not touch the silvered surface.*

If these operations have been carefully followed, a good Plexiglas mirror will be obtained. The color and adhesion should be good. If spots or streaks appear they are probably due to lack of cleanliness before the first coat of silver is applied. If pinholes are found in the silver deposit, these are probably due to failure to rock the silvering tray sufficiently to prevent the precipitate from sticking, or to insufficient swabbing and rinsing after the application of the second coat. At the same time too much swabbing will produce thin spots in the final silver deposit. Finger print marks are probably due to touching the Plexiglas or the silvered surface.

Since this silvering process is not very economical, it may be desirable to recover the surplus silver. This may be done by applying a chloride recovery process directly to the contents of the residue container.

It is preferable to add Lykopon to the residue container in place of the nitric acid. This precipitates all of the silver that remains in the solution as a flocculent precipitate. Since the precipitate originally in the spent solution is also pure silver, it is only necessary to wash (by decantation) this precipitate free of all soluble salts. The residue may then be taken up with nitric acid and pure silver nitrate crystallized from the resulting solution.

If upon standing and use Solution A (sodium hydroxide) becomes turbid, it may be desired to filter rather than discard it.

Walker cleans the surface of the plastic with gasoline, thereafter washing in running water, and subsequently treating with a solution of stannous chloride, after which the silvering process is carried out.

Hepburn uses the Newt modified form of Brashear process, which is recommended to give best results at 70 to 80 deg. F.

Reducing Solution "A"

Granulated sugar 100 g.
Nitric acid 5 cc.
Alcohol 200 "

Make up to 1 liter with water. This solution improves with age.

Stock Solution "B"

Silver nitrate 10 grams
Water 1 liter

Stock Solution "C"

Ammonium hydroxide (sp. gr. 0.880) 200 c. L.

(References and Part IV will appear in the December issue)

Adjustable Racks Cut Loading Time

ADJUSTABLE racks designed by employees in the Finishing and Plating Department have almost halved the time required to load work for anodizing at The Glenn L. Martin Company, Baltimore, Maryland. In addition, the use of these racks in place of spring hangers for all tubes, formed parts and heavy gauge flat work has resulted in substantial savings in electric current and has permitted a far greater utilization of the available anodizing tanks—thanks to the orderly arrangement of the parts.

There are two basic types of rack, with each being made in several sizes so that by using them singly or in combination practically every size and type of part can be handled. The first type of rack is an aluminum alloy center post with a frame at the bottom on which parts can be stacked around the center post in the manner of a log cabin and a pressure plate at the top to hold the racked work in place. The top edges of the bottom frame are toothed to keep the work from slipping, and the pressure plate is adjustable and held in place by a spring and pin inserted in holes in the center post. The top of the center post is in the form of a hook to permit easy handling with an overhead conveyor.

The second type of rack has two posts with a fixed channel section separating them at the bottom and a moveable similar section at the top. Top edges of the lower section and bottom edges of the top section are toothed to prevent slipping. Work is loaded on the bottom section and the top clamped down to hold it in place similarly to the single post racks. In loading large parts which would cover each other such as large corrugated sheet, smaller parts are used as spacers, thus utilizing the solutions to the utmost and avoiding to a large extent their waste on handling equipment.

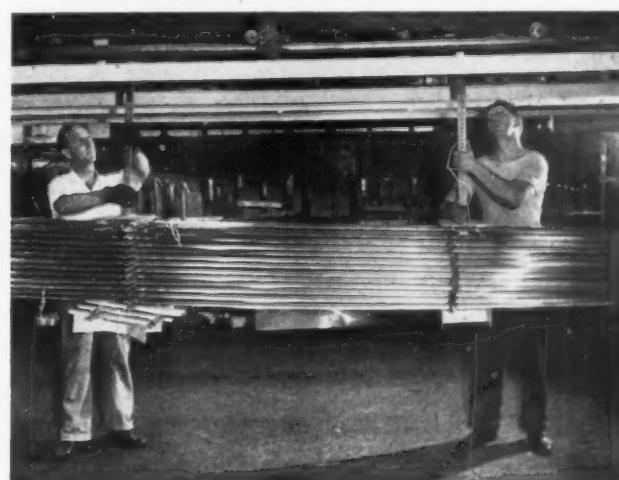
The new racks are both simple and durable and provide a sure and positive electrical contact. Where the former spring hangers had to be cleaned after each usage and soon lost their temper and springiness, the new racks have an almost indefinite life, with only the bottom frame having to be cleaned after usage. Since this frame is of straight rigid metal construction, it is easily cleaned and unaffected by the cleaning bath.



(Above) Parts are unloaded from a single-post anodizing rack at The Glenn L. Martin Company, Baltimore, Maryland. In the background can be seen several of the fully loaded racks showing how the parts are criss-crossed around the pole in log cabin fashion.

(Below, left) Loading stringers on to the two-post type anodizing racks at The Glenn L. Martin Company. Because of the length of the parts, two racks are used. It should also be noted how other smaller parts are used as spacers to hold the longer parts apart.

(Below, right) A loaded anodizing rack is placed on the overhead conveyor in the Finishing and Plating Department at the Glenn L. Martin Company. From here on, the anodizing operation is automatic.



Ancient Trade Guilds

By JOSEPH DANFORTH LITTLE

IN THE history of the workers in the decorative arts, nothing is more interesting than the story of the ancient Guilds. In England and also in France, in the middle ages, the arts and crafts were protected by the formation of Guilds. One of the earliest trade bodies of which we have a record, is the "Guild of Goldsmiths of London," ranked in history as one of the most important and influential of all crafts. A fraternity of master workers of Goldsmiths was formed to maintain community interests in 1180. Its object being "for the promotion of trade and moral worth." Its quarters were originally in Foster Lane then called Goldsmiths' Row, where Goldsmiths' Hall still stands. The Guild was incorporated under the name of "Wardens of Goldsmiths of the City of London." They received their first charter from Edward III which set forth a series of strict regulations to govern the making and selling of gold and silver wares, and for the protection of honest craftsmen and also the public. They had control in these matters over all England.

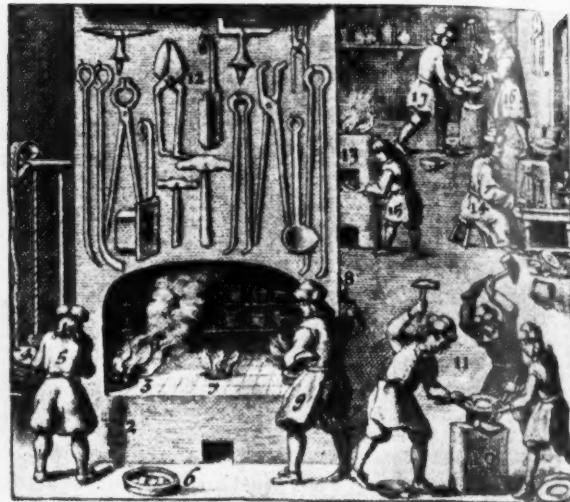
Marks of Quality

Marks for gold and silver wares were introduced and by these marks the name of the maker of an article could be identified. These marks also indicated that the article in question had been pronounced up to the standard by appointed authorities. The wardens used to make periodical visitations not only in London but also throughout the other important cities of England. They had the power to correct any abuses which had crept into the trade, to search for false wares and to imprison or fine any person who made such false wares, and to confiscate all forgeries. The makers were brought to trial before the Guild Council. The standards of the Guild were inflexible and heavy punishments were inflicted upon the guilty. Fines were paid in money or "Pipes of Wine," a pipe of wine being a cask containing two hogsheads or 126 wine gallons.

There is an interesting record of 1597 concerning the conviction and sentence of two men who had made a counterfeit article and stamped counterfeit marks thereon. They were sentenced to stand in the pillory at Westminster with their ears nailed thereto and with a paper above their heads stating their offence to be "for making false plate and counterfeiting their Majesties touch." They were then put in the pillory at Cheapside, had one ear cut off and were then taken to Foster Lane to Fleet Prison and had to pay a fine of ten marks. Edward IV gave the Goldsmiths' Guild additional powers. They were permitted to use a common seal and they had also the right to hold land.

Spirit of Workmanship

Undoubtedly many have seen in the museums of Europe or America, or pictured in old books, fine examples of the art of the silversmiths of old. Something more than skill and a lifetime of experience enabled these old guildsmen to



Engraved Frontispiece to "Touchstone" of 1677

win for their work the admiration of the world. The Goldsmiths' Guild, like other Guilds, has, of course, completely changed in character. The early stage was the golden age of the trade guilds. As they increased in wealth and power, not only their original character changed but they lost their original object as well. Dominating the thoughts as well as the hands of these guildsmen, as they worked, was pride in the skill which made possible their fine achievements, and greater pride in the Guild spirit. These high thoughts were ever with the guildsman as he worked, lending greater deftness to his hands and greater beauty to his masterpiece.

In these old industrial guilds of goldsmiths and silversmiths, it was the creation of ideals and beautiful forms rather than a pecuniary return that inspired the members, increased their love of and for the craft, and elevated it above commercialism. Under that spirit, no man thought of his work as a task, but as an art. No man was driven or would impair his art by hastening unduly his work. Patient toil made each piece of silver or gold a masterpiece. *No man thought to give less than the best that there was in him for the honor of himself and the Guild. Under that spirit the Guildsman's hand took on the touch of genius and produced masterpieces of the silversmiths' art.* Frequently these old guild ideas and traditions were passed down from father to son through several centuries.

The craftsmen of the ancient Guild of Goldsmiths of London and their great love for the Guild is not unfamiliar. Oftentimes beneath the arched windows of the old Guild Hall or in some quaint shop, a worthy guildsman toiled for months and sometimes years, on a piece of silver, such as a tankard, beaker or a bowl, which would one day grace the table of some English king, queen or duke. In reverence the old masterpiece was conceived. Jealously the old guild-master guarded the reputation of his craft, and when he had completed a piece worthy of his stamp and a credit to his Guild, he would send it to Guild Hall where it would be tested by the warden, appointed by the Crown, and if found up to standard, the warden would stamp it with the Hall Mark, then the maker would with just pride stamp it

with his own stamp, even as Cellini did a golden vase, or as Rubens painted a picture.

Centuries have passed since first a master's signature became the symbol of a priceless craftsmanship, but there are still a few silversmiths in Europe and America making silverware entirely by hand without the aid of any mechanical tool, who are justly proud of their work and their ability. All gold and silver wares manufactured in London today, must be assayed and stamped at Guild Hall.

Guildsmen as Bankers

The Guild of Goldsmiths became a powerful fraternity. Until about 1700 the goldsmiths were the only bankers of the community. There were no others, and a number of the older firms of bankers still existing, had their origin in a goldsmiths' shop. The earliest form of bank notes was called "Goldsmiths' Notes." Goldsmiths also supplied the bullion for foreign trade and in those times of insecurity it was the fashion to carry about the more valuable articles of personal adornment such as gold sword hilts, buckles, chains and rings as the safest and readiest way of holding value, quite as much as for gratifying personal vanity.

Other Guilds

There were many other Guilds such as *The Girdlers' Guild*, founded in 1448; *The Broders'*, founded in 1561; *The Comb Makers'*, founded in 1635; *The Gold and Silver*

Wire Drawers', founded in 1693; the *Fan Makers*, founded in 1719; the *Cordwainers' Guild*, founded some fifty years before Columbus sailed on his voyage of discovery to America. The charter of this last named Guild was granted by King Henry VI. Some people today confuse these guilds with the modern trade unions. As a matter of fact, as many differences as resemblances mark the two. The ancient Guild was the organization of all the members of a craft—employers, journeymen and apprentices and not merely of employees. It was a community in and of itself with certain rights and prerogatives respecting its trade, commonly recognized, and usually confirmed by royal charter. It is interesting to note that The Cordwainers' Guild, which was originally a guild of workers in leather or shoemakers, acquired a new member a few years ago, notably the late Prime Minister of the United Kingdom—Hon. Neville Chamberlain. He was accepted for two reasons: First, because he was a distinguished person; second, because for a century or so, other members of his family have been on the Guild roster. His predecessor in office, Earl Stanley Baldwin is an honorary assistant of the same guild or society. Like other medieval trade guilds, the Cordwainers' Company nowadays finds its chief avocation in the preservation of tradition, in social intercourse and in philanthropic work. It is presumed that the late Prime Minister was not required to demonstrate his proficiency with the awl, nor was he expected to stick to the shoemaker's last.

Notes on Industrial Health Hazards Connected with Cadmium Plating

By PAUL A. NEAL¹, LAWRENCE T. FAIRHALL¹ and K. GUSTAF SODERBERG²

THE greatly increased use of cadmium plating for the protection of metal articles, especially in war industries, makes it desirable that information about possible health hazards be disseminated among workers who do cadmium plating and handle cadmium plated articles, and especially among new workers who have no previous connection with cadmium.

While ingestion of cadmium salts through eating and drinking of acid food products which have been in contact with cadmium plated articles has caused a number of cases of poisoning, our present interest is centered around inhalation of cadmium containing dusts and fumes.

The first symptoms are usually dryness of the throat, cough, headache, vomiting and a sense of constriction of

the chest. Later symptoms are predominantly referable to the respiratory system and are characterized by cough, pain in chest, severe dyspnea, and prostration. Such severe lung damage usually manifests itself hours after exposure, and cadmium fumes can be breathed in fatal concentrations without enough discomfort to drive the worker away from the exposure.

No extensive study of permissible concentration of cadmium has been made with respect to exposure of human beings. However, American Standards Association in its "American Allowable Concentrations of Cadmium" has accepted as a maximum 1 milligram of cadmium in 10 cubic meters of air.

As a rule, few unsuspected hazards surround the cadmium plating operation itself. Cyanide plating solution is poisonous, and care should be taken that it does not reach the mouth of the operator, either by direct splashing

or via his hands. Where insoluble steel anodes are used to plate into deep recesses, or the like, considerable spray may evolve from the plating tank. In such cases, the tank should be ventilated in the same fashion as a chromium plating tank.

Greater hazards are encountered in operations auxiliary to the cadmium plating operations. In mixing a plating solution, it is imperative that the cadmium containing salts be not inhaled. It is particularly dangerous to burn cadmium. Deaths are recorded as having taken place when a workman has used a blow torch to burn off cadmium plate from inside of tanks and from plating racks. Cadmium should not be removed in that fashion but by electrolytic or chemical stripping. Similarly, plating departments should avoid remelting of cadmium scrap unless assurance is had that the melting equipment is thoroughly ventilated. It

(Concluded on page 680)

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THIS IS WASHINGTON—

By George W. Grupp
METAL FINISHING's Washington Correspondent



Metallic Coatings on Plastics Discussed at Baltimore-Washington Branch Meeting

In an effort to win the ten dollar prize offered to the "Meeting Chairman of the Month" who brings out the largest attendance during the 1944-1945 season, Dr. Abner Brenner got out a good sized crowd, in spite of the bad weather, from Baltimore and Washington to attend the first meeting of the Baltimore-Washington Branch of the American Electroplaters' Society under the new and able president, Kenneth M. Huston, and to hear Mr. Harold Narcus, chief chemist of the Plating Processes Company, Holyoke, Massachusetts, read a very interesting and informative paper on "The Deposition of Metallic Coatings on Plastics" which he illustrated with lantern slides showing countless samples of metallic coated plastic articles such as naval insignia, automotive door and window handles, honorable discharge buttons, household door knobs, jewelry, hardware, radio parts such as loop antenna, aircraft parts such as instrument panels, machine parts, industrial cams, pick-up units of electronic equipment, and sump pumps. In addition, he showed slides showing barrel and still tank plating equipment in the process of depositing metallic coatings on plastics. In his paper Mr. Narcus pointed out that some of the secrecy of metallic coating methods on plastics should be lifted for the benefit of the industry as a whole. And he urged the members present to familiarize themselves with the various new materials which can be plated such as plastics. It is the opinion of Mr. Narcus that plating enhances the usefulness of plastics since it increases their heat resistance, rigidity, strength, and corrosion resistance and reduces their absorption of water. After reviewing the advantages and disadvantages of different methods of metallic deposition on plastics he declared that he believed that the best process is the chemical reduction method. Before concluding his paper he described briefly the various methods of preparing different kinds of plastics for plating with different kinds of metals.

Baltimore-Washington Branch Contributes \$100 for Electroplating Research

Dr. William Blum outlined to the members of the Baltimore-Washington Branch the program for raising a large sum of money for post-war electroplating research, which is to be conducted by the National Bureau of Standards for private industry. He recommended that each member of the Branch contribute one dollar a year toward this research fund. This recommendation was voted upon at once by the members of the Branch with the result that a \$100 Government bond of the Branch was immediately made available to the Research Committee. Also, upon Dr. Blum's recommendation, President Kenneth Huston will appoint a committee which will make a list of local firms who will be asked to contribute from \$25 to \$100 and over to the contemplated plating research project to be conducted by the National Bureau of Standards. Mr. Huston will also appoint a Branch liaison representative who will maintain contact with the post-war plating research committee.

Olsen Arranges Interesting Meetings for Baltimore-Washington Branch

Walter A. Olsen, Librarian of the Baltimore-Washington Branch of A.E.S. has arranged to have Mr. C. H. Sample of the Bell Telephone Research Laboratory address the Branch on "Salt Spray" at the November meeting which will be held in Baltimore. Mr. Shacat of United Chromium Corporation will speak on "Porous Chrome" at the December meeting which will be held in Washington. And Robert Sizelove of Frederick Gumm Chemical Company, will address the January, 1945 meeting in Baltimore on the subject of "Promat Process" or on "Chemical Finishes for Magnesium and Magnesium Alloys."

Dr. William Blum Honored

Dr. William Blum, a charter member of the Baltimore-Washington Branch of the A.E.S., who has been the elder statesman and Rock of Gibraltar of the Branch, received a hearty applause and standing vote of congratulation at the past meeting of the Branch for his being honored with the award of the Acheson Prize of the Electrochemical Society.

Maurice Lewis Is With WPB

Maurice A. Lewis, who is well known to the electroplating industry of New England as Technical Director of Doe Ingalls, Inc., of Everett, Mass., is now Chief of the Glycols and Amines Unit of the WPB Chemicals Bureau. During his 24 years with Doe Ingalls, Mr. Lewis had considerable experience with chemical solvents, electroplating and plastics.

Soderberg Now in the WPB's Office of Operations

Gustaf Soderberg, who has been Head Industrial Specialist on Electroplating and Finishing and consultant on lead coating in the Conservation Division of the War Production Board since July, 1944, is now a consultant on cadmium and electroplating on the staff of WPB Conservation Officer James H. Hansen. Mr. Soderberg has been serving the Government on extended leave of absence as Director of Research of the Udylite Corp. of Detroit.

AA-1 MRO Ratings Anodizing and Electroplating Equipment Manufacturers

Controlled Materials Regulation No. 5 as amended September 28, 1944, provides that a preference rating of AA-1 may be used for MRO by manufacturers of anodizing equipment, electroplating equipment, generator sets, metal heat treating equipment, and ventilating equipment and by producers of metal cleaning preparations, paints, varnishes and lacquers.

Anodizing Equipment Limitation Order L-123 was amended on October 6, 1944, to include portable conveyors under the order and to define anodizing equipment as meaning "any of the following equipment intended to be used in the electrochemical treatment of the surface of any metal to produce a corrosion-resistant film on the surface of the metal, leaner tanks, rinse tanks, anodizing tanks, chrome dip tanks, dye tanks, linings for tanks, anode and cathode rods, racks, motor-generator sets, generators, rectifiers, tank rheostats, panel boards, automatic anodizing machines, baskets, voltage regulators, and ventilating equipment."

Unrated Purchase Orders of Metal Finishing Equipment Does Not Need WPB Authorization Priorities Regulation No. 24 was amended on October 13, 1944, to eliminate the necessity for WPB authorization to place unrated purchase orders for machinery and equipment covered by the orders on

list A of the regulation such as General Industrial Equipment Order L-123 which covers electroplating and anodizing equipment. The amended order also tightens up the WPB's policy on assigning preference ratings on purchase orders needed for the resumption or expansion of civilian production.

Maintenance, Repair and Operating Supplies Order Amended A number of small changes were made in chemical industries maintenance, repair and operating supplies Preference Order P-89 as amended October 4, 1944. The amended order

requires that producers who need mechanical labor saving devices to compensate for losses in manpower must now submit detailed information. It also now provides that "when application is made under paragraph (e) (1) for an AAA rating, or for an equivalent delivery directive, it is essential that the following information be added: All relevant purchase order numbers including the fabricator's job number; the delivery date promised on the basis of the requested special rating; and a list of all suppliers from whom quotations have been requested, together with their answers." The language under "applicability of the regulation" was changed to read: "This order and all transactions affected hereby are subject to all applicable provisions of War Production Board regulations, as amended from time to time. Provided, however, That no producer shall be subject to the provisions of CMP Regulation No. 5 or No. 5A, and no producer shall obtain any material under the provisions of either of said regulations."

Controlled Materials Plan Division of WPB Abolished The Controlled Materials Plan Division and the Production Controls Bureau of the War Production Board were abolished on October 13, 1944.

The work of this Bureau and this Division are taken over by the WPB's Program Office.

When Controlled Materials May Be Accepted Inventory Direction 20 to CMP Regulation 2, issued on October 4, 1944, provides that "Notwithstanding the provisions of CMP Regulation 2 a user of controlled material who has been given an authorized production schedule under Priorities Regulation 25 may accept delivery of any item of controlled material which he needs to fill that production schedule providing his inventory is not, or will not by virtue of accepting the delivery become, in excess of his succeeding six months requirements." Direction 5 to PR 1, issued on October 4, 1944, makes the provision.

Conservation Division of WPB Discontinued The Conservation Division of the War Production Board was discontinued on October 31, 1944. Chairman J. A. Krug of the WPB is of the opinion that the diminishing amount of work remaining to be done in connection

with conservation can now be handled satisfactorily by other divisions of the WPB.

Hansen Now Conservation Officer of WPB James H. Hansen, formerly Deputy Director of the recently dissolved Conservation Division of War Production Board, is now Conservation Officer of the WPB's Office of Operations Vice-Chairman under Hiland G. Batcheller. Mr. Hansen will maintain such records and personnel as are necessary in the continuation of certain special contracts and projects of the dissolved Conservation Division such as (1) United States Conservation Coordinating Committee, (2) American Standards Association contract, (3) Federal Specifications Project, and Tin and Cadmium Conservation projects. W. S. Johnson will continue to be Hansen's administrative assistant; his tin, lead, bronze, and solder special consultant will be Arthur R. Maupin, who held a similar position with the Conservation Division; and his cadmium and electroplating consultant will be Gustaf Soderberg.

Post-war Orders May Be Accepted Interpretation No. 1 to PR 1 makes it clear that manufacturers may accept post-war orders, but they are not permitted to "schedule such orders for production, order material or place material in production to fill such orders until after the applicable WPB restriction is removed."

New Settlement Forms Issued for Terminated Fixed-Price Contracts Robert H. Hinckley, Director of the Office of Contract Settlement, on October 10, 1944, announced that the new standard forms to be used for settlement of terminated fixed-price (lump sum) supply contracts are now available. These forms are much simpler and should aid in speeding-up the settlement of terminated contracts.

When Inventory Restrictions Do Not Apply to Capital Equipment Direction 6 to PR 1, issued on October 4, 1944, provides that "the inventory restrictions stated in Section 944.14 of Priorities Regulation 1 do not apply to items of capital equipment which a person is authorized to buy under Priorities Regulation 24 or which he obtains without priorities assistance." Therefore a person "may accept delivery of any item of capital equipment which he is authorized to buy pursuant to Priorities Regulation 24 or which he gets without priorities assistance."

War Contractors May Buy Government-Owned Equipment in Their Plants Director Robert H. Hinckley of the Office of Contract Settlement, issued Regulation No. 4 on September 29, 1944, to assure the prompt removal of Government-owned equipment from private plants whose war contracts have been terminated. This regulation gives the contractor the opportunity to either buy the equipment or have it removed from his plant within 60 days after making request for removal.

Apprenticeship Plans for Veterans Being Considered by WMC Officials of the Apprentice Training Service of the War Manpower Commission announced on September 26, 1944, that they have been working on a plan for the revitalization of apprenticeship, with opportunities for many discharged veterans to learn trades. After a four-day meeting of management and labor representatives of apprenticeship programs in twenty states it was learned that veterans will have opportunities to enter trade through apprenticeship in many fields, chiefly in metal working and construction industries.

Chromium Plated Items Released from Inventory

plated door handles, and 8,400 chromium plated name plates that are fully fabricated and in inventory in the production of domestic cooking stoves.

Church Goods Order Revoked But Restrictions Continue

orations and other items essential for purposes of conducting religious services, was revoked on October 2, 1944, but the use of materials for the production of church goods will continue to be controlled by the various conservation orders wherever such restrictions are necessary. Copper is controlled by M-9-c; zinc by M-43; tinplate by M-21-e; zinc by M-11-b; lead by M-38; and, chromium chemicals for plating iron and steel by M-18-b.

Copper Products Production Outlook Bright

be about 379,000 tons per quarter after the defeat of Germany. This will provide 281,000 tons for military and essential civilian uses and 98,000 tons for non-essential civilian uses. WPB officials told the committee that they expect an increase in production in wire mills with the fall of Germany because of the deferred demand of private and public utilities and others. E. H. Westlake, of the Tennessee Copper Company of New York City, and John A. Payne, of the Consolidated Coppermines Corporation of New York City, were recently made members of the committee.

Dual Control Over Bright Work Ended

hiles, accessories and replacement parts by revoking Limitation Order L-69 on September 26, 1944. Cadmium Order M-65, Chromic Acid Order M-18-b, Copper Order M-9-c, and Nickel Order M-6-b remain in effect.

Flatware Restrictions Should Be Eased Committee Recommends

the elimination of restriction on the distribution of stainless steel flatware. They also requested permission for the industry to produce 5-inch and 8-inch oval bowl soda spoons, oyster forks, dinner forks, tablespoons, salad forks, knives, dessert spoons, and teaspoons.

Flatware and Enamel Ware Shipments Increasing

that during the first two quarters of 1944 the total shipments of flatware amounted to \$8,080,000 as compared with \$5,362,000 for the same period in 1943. The total shipments of enameled ware during the first two quarters of 1944 amounted to \$11,522,000 as compared with \$10,108,000 for the same period in 1943.

Fuel Oil Reserves May Be Had By Industrial Consumers

inventory reserves sufficient to fill their storage tanks, regardless of former limitations on the amount of reserve allowable. This is clearly indicated in Amendment 28 to Revised Ration Order 11, effective October 13, 1944.

It was announced on September 21, 1944, that the Knox Stove Works, of Knoxville, Tenn., has been given permission to use 14,000 chromium

Galvanized Ware Manufacturers Seek Permission to Make a Greater Number of Items

At the September meeting of the WPB Galvanized Ware Manufacturers Industry Advisory Committee it was learned that shipments of galvanized ware, during the past year have been "highly satisfactory." The committee recommended that utility baskets, ash sifters, diaper cans, liquid and dry measures, and watering pots be added to the list of items permitted to be made under Order L-30-a. And it was pointed out by the committee that the maintenance of employment in the galvanized ware industry after "X-Day" will depend chiefly upon the availability of materials.

Military Insignia Order Revoked

Limitation Order L-131, which controlled the manufacture of military insignia, was revoked on October 2, 1944, because the order imposed no quotas or specifications other than restrictions on the use of silver and copper. These materials can be controlled the WPB believes through Silver Order M-199 and Copper Order M-9-c. Under M-199 manufacturers are permitted to use Treasury silver to make military insignia, decorations, medals, badges, qualification bars and other official articles described in Schedule C of this order. Under M-9-c copper and copper base alloy may be used to make buttons and insignia for military uniforms.

Nickel-plated Wire May Be Used

Members of the Incandescent and Fluorescent Lamp Manufacturers Industry Advisory Committee were told by WPB officials at their September meeting that nickel is tight because of a shortage of rolling facilities. For this reason, they said, it may again be necessary for lamp manufacturers to discontinue the use of nickel wire temporarily and instead use *nickel-plated steel wire* as they did in 1943.

Porcelain Enameling Utensil Committee Wants Size Restrictions Eased

Members of the Porcelain Enameling Utensil Industry Advisory Committee at their September meeting recommended the removal of size restrictions on cooking, household and hospital enameled ware utensil in preparation for the resumption of peace-time production. Revocation of L-30-b on X-Day as proposed by WPB was approved by the committee.

Tin Exports from Bolivia Decline in April

The total tin exports from Bolivia in 1943 was 40,131 tons. The tin concentrates exported in April, 1944, decreased 2,656 metric tons from

3,154 tons in March. The exports in February amounted to 2,906 tons.

A SULFATE-CHLORIDE SOLUTION
(Concluded from page 668)

More or less bright deposits can be obtained with the sulfate chloride bath when the pH is below 3.0, but these deposits are quite often rough for thickness greater than 0.001 in. (0.025 mm.).

After experimenting with a number of addition agents, it was found that smooth, semi-bright deposits could be obtained at the higher pH values by addition of 2 to 4 cc./L. of o-cresol sulfonic acid and 0.25 to 0.5 g./L. of duponol "ME" to the sulfate-chloride composition.

(c) Other Applications

While no extensive tests were made on applications of the sulfate-chloride iron bath other than for electrotyping and stereotyping, some preliminary experiments on electroforming indicate that this solution can be used successfully for the electroforming of such articles as molds for die-casting, plastic molding, phonograph records, and for stamping dies. The relatively high rate of deposition obtainable with this bath would seem to indicate an advantage over other iron solutions used for similar purposes.

Preliminary tests also indicate that the solution can be used successfully for the building up of worn or undersized machine parts.

Patents

Copper Recovery

U. S. Pat. 2,356,329. A. E. Lundbye, assignor to The Crowell-Collier Publishing Co., Aug. 22, 1944. The method of recovering copper from printing plates made up of a base metal with a coating of copper and nickel thereon, said base metal having a lower melting point than copper, which consists in electrolytically stripping off the nickel; coating the stripped surface with a whiting; melting off the base metal which leaves but a thin coating of the same on one surface of the plate; oxidizing the thin coating by heating and rapidly cooling the plate to change the coating to a scale; dissolving the surfaces of the plate in a plurality of minute areas to thus crack and loosen the scale; and removing the loosened scale from said plate.

Coating Soldering Tips

U. S. Pat. 2,356,583. L. N. Hampton, assignor to Bell Telephone Laboratories, Inc., Aug. 22, 1944. The method of forming a heat transferring element such method consisting in annealing and forging a piece of oxygen-free copper to form a cylindrical portion, a conical portion, another cylindrical portion and a tapered portion, electrodepositing iron on one face of the end of the tapered portion, heating the copper and the deposited iron portion in aluminum powder to form a coating on the copper and the iron and removing the aluminum from a portion of the iron to serve as the working surface of the element.

Recording Matrices

U. S. Pat. 2,356,639. A. Woitscheck (Germany), vested in the Alien Property Custodian, Aug. 22, 1944. An apparatus for producing matrices in a galvanic bath from mechanically recorded flexible sound bands having a prepared conductive surface at the recorded portion thereof, comprising a supporting cathode for receiving the band with its recorded and prepared surface exposed, said cathode having a helical rail composed of spaced convolutions of channel-shaped cross-section, angular conductive segments extending around the edges of said helical rail and adapted to overlie the margins of the band in coextensive conductive relation with said conductive surface thereof, angular insulating segments extending over the outer surfaces of said conductive segments, and clamping means for securing the segments in position.

Pipe Galvanizing

U. S. Pat. 2,356,739. K. A. Ericsson and W. T. Mahla, assignors to National Tube Co., Aug. 20, 1944. In apparatus for continuously galvanizing pipes and the like

including a tank, the combination with conveyor means for conveying the pipes forwardly and downwardly endwise into said tank combined with a lateral movement of said pipes, of a rotary sinker device rotatable about a horizontal axis and positioned in the path of travel of the elevated rear portions of the individual pipes, said device having a circumferential spiral cam surface whose radial dimension increases to a maximum corresponding to the total submergence travel of said pipe portions, said cam being rotatable in a direction providing the surface travel thereof in the direction of forward travel of the pipes, said cam surface also being progressively extended in the direction of lateral travel of the pipes for continued contact of the latter and said surface during such depression and combined movement of said pipes.

Cleaning Composition

U. S. Pat. 2,356,747. M. I. Bowman and H. Packer, Aug. 29, 1944. The process of cleaning machinery parts and similar hard surfaces of foreign matters such as carbon, grease, paint, dirt and the like which process consists of applying thereto a composition comprising the following chemicals in the following proportions by volume: neutral coal tar oil, approximately 40 percent; monoethanolamine, approximately 15 percent; oleic acid, approximately 15 percent; ethylene glycol, approximately 15 percent; orthotolididine, approximately 15 percent; ethyl silicate, approximately .5 percent; and phosphoric acid, approximately .5 percent, and thereafter removing the reaction product resulting from the applied composition in combination with the said foreign matters to be removed.

Electrodeposition

U. S. Pat. 2,356,897. J. R. Stack, assignor to Nassau Smelting & Refining Co., Aug. 29, 1944. The process for the electrodeposition of metal of the group consisting of copper, tin and lead, which comprises electrolyzing an electrolytic bath consisting solely of an aqueous solution of an aromatic sulphonate acid and dissolved metal of said group with an insoluble anode made of an alloy consisting of lead and antimony in which the amount of antimony present is at least about 20% of the total composition but is insufficient to materially increase the operating voltage over that required with such an anode containing about 20% of antimony.

Flowing Electrodeposits

U. S. Pat. 2,357,126. J. S. Nachtman, Aug. 29, 1944. In a method of treating metal strip having a metal plating on surface portions thereof to provide a bright, uniform and adherent coating of improved characteristics, the steps of heating the strip to bring the entire strip to a temperature approaching but short of the melting point of the plating in one heating zone, then further heating the strip in a second heating zone communicating

with the first zone to melt the plating, then cooling the strip in a cooling zone communicating with the second heating zone to solidify the plating, controlling the temperatures of the heating and cooling steps so that the plating is melted for only a relatively short period of time, and protecting the strip by non-oxidizing fluids during the heating and cooling steps and the passing between zones.

Bus Bar Clamp

U. S. Pat. 2,357,171. E. T. Carlson, assignor to The Trumbull Electric Mfg. Co., Aug. 29, 1944. A rigid connecting sleeve having a flat passage to receive bus bars, a single clamp plate slidable edgewise in said passage and having tapered projecting ribs on one face and clamp screws in opposite ends of said sleeve for forcing said plate edgewise in said passage to clamp the bars therein and means for limiting longitudinal movement of said plate in said passage.

Galvanizing Rods

U. S. Pat. 2,357,420. A. S. Moore, assignor to Bethlehem Steel Co., Sept. 5, 1944. An apparatus for producing uniform ductile coatings on rods and the like coated with molten metal, comprising a plurality of aligned air rings for smoothing the coating and making uniform the coating thickness, and means for rapidly advancing and spinning the rod through the air rings.

Anodizing Iron

U. S. Pat. 2,357,554. J. N. Sears, assignor to Schlage Lock Co., Sept. 5, 1944. The method of producing a coating of ferric acetate on a ferrous metal, which comprises subjecting the ferrous metal as anode to electrolytic treatment in an electrolyte consisting of from 7 to 10 ounces of lead acetate per gallon of water, di octyl sodium sulfocarbonate—2 ounces per gallon of water, a sufficient amount of ammonium hydroxide to render the electrolyte slightly alkaline and employing a current density of ten to sixty amperes per square foot of anode surface and at nine to sixteen volts.

Sandblasting

U. S. Pat. 2,357,599. W. P. Mott, assignor to J. M. Schatz and H. R. Glasser, Sept. 5, 1944. In a sand blasting device, a casing, a cage in said casing adapted to retain the articles to be treated, means for resiliently supporting said cage in floating position, and means for delivering a sand blast to said cage.

Abrasive Sanding Belt

U. S. Pat. 2,357,823. L. A. Hatch and J. E. Clarke, assignors to Minnesota Mining & Mfg. Co., Sept. 12, 1944. An endless abrasive belt for sanding hard metals and the like comprising a flexible backing, a coating of a bond thereon and embedded in said bond a layer of aluminum oxide abrasive

grains of commercial grit sizes which have been heat treated at a temperature within the range of 1250° C. to 1350° C. for a period of time sufficient to increase the toughness thereof.

Metal Coated Plastics

U. S. Pat. 2,357,950. G. A. Goessling, Sept. 12, 1944. The process of making a molded covered plastic article in a mold having a removable element forming a portion of the mold cavity of said mold which consists in applying a coating of spray metal to the mold cavity forming portion of said element in the removed position thereof, mounting said element in operative position in said mold, and then molding said article under pressure in said mold, whereby said coating is bonded to said article and is detached from said element when the said article is removed.

Plated Cooking Utensil

U. S. Pat. 2,358,104. A. C. Scavullo, assignor to V. K. Scavullo, F. Scavullo, C. Scavullo, M. S. Seagert and M. S. Scott, Sept. 12, 1944. The process of forming a culinary vessel which comprises, deep drawing a composite sheet of chromium-nickel stainless steel and low-carbon mild steel to the shape of the desired vessel, with the mild steel outside, and then electroplating copper onto said mild steel to the extent that the sum of the thicknesses of mild steel and copper substantially exceeds the thicknesses of stainless steel.

Spray Nozzle

U. S. Pat. 2,358,177. R. D. Madison, assignor to Buffalo Forge Co., Sept. 12, 1944. A spray nozzle including a housing having formed therein a whirl chamber for liquid, a tangential inlet for the liquid into said chamber, a discharge orifice located substantially coaxial with that axis about which whirling takes place in said whirl chamber, and a ribbed body in said whirl chamber adjacent to but spaced from said orifice and having ribs extending substantially parallel to said axis.

Abrasive Blasting

U. S. Pat. 2,358,322. J. E. Foster, Sept. 19, 1944. A blasting machine comprising a rotor having a plurality of radial slinger blades; means for supplying abradant particles to the machine; and means individually associated with each blade for measuring out a quantity of the abradant particles and for feeding those measured particles to the associated blade; and electro-magnetic means adjustably positionable adjacent the rotor to operate the feeding means at a pre-determined point, thereby to control the zone of discharge from the blades.

Nickel Plating

U. S. Pat. 2,358,995. W. L. Pinner, assignor to Houdaille-Hershey Corp., Sept. 26, 1944. In the method of electrodepositing nickel using an electrolytic sheet nickel anode in an electrolyte of a concentration equal to at least 0.75-N nickel and including

a chloride, the improvement enabling the use of such electrolytic nickel anodes without bagging which comprises, maintaining the chloride normality and pH values within specified limits.

Vitreous Enamel

U. S. Pat. 2,359,283. W. J. Baldwin, assignor to Homelaya, Inc., Oct. 3, 1944. The method of producing a metal article having a vitrified coating with a crinkle finish which comprises applying to the metal article a vitrifiable coating compound that contains a frit of usual composition including cryolite and which frit also includes unreacted antimony trioxide, firing the article so coated in an oxidizing atmosphere to vitrify the coating and under conditions which preserve in the finished coating some unreacted antimony trioxide, and cooling the ware after firing.

Abrasive Blasting

U. S. Pat. 2,359,313. W. L. Keefer, assignor to Pangborn Corp., Oct. 3, 1944. An abrasive throwing apparatus comprising an abrasive feed control member of generally circular cross-section, one end of said member having an edge which is inclined to a plane perpendicular to the axis of the member, forming a discharge edge which is generally parallel to the axis of the member, means for feeding abrasive within said member at a point further inwardly from said end than said inclined edge, means supported for movement within the interior of said member to move the abrasive circumferentially around the interior thereof and toward said discharge edge whereby the abrasive advances axially toward said end of the member and is delivered from said discharge edge, and blades mounted for rotatable movement about said member for receiving the abrasive delivered from said discharge edge.

Tumbling Barrel

U. S. Pat. 2,359,322. J. Lupo, Oct. 3, 1944. In a tumbling apparatus, an open front housing, a tumbling barrel mounted for rotation on a horizontal axis within the housing, said tumbling barrel having a charging opening for introducing thereto the articles to be tumbled together with tumbling elements and a comminuted compound, a screen mesh cover for said charging opening adapted to be arranged over the charging opening, means supported within the casing below said barrel for receiving the compound when the barrel is rotated with the screen mesh cover applied thereto, and a displaceable shield arranged over the open front of the housing for preventing the escape of the fine particles of the compound from the housing and their dissipation outside thereof.

Barrel Tumbling Process

U. S. Pat. 2,359,323. J. Lupo, Oct. 3, 1944. A method of processing articles which consists in tumbling the same in a completely closed receptacle for a predetermined length of time together with a tumbling mixture composed of particles of material coated with

an abrasive and tumbling elements of large size than said particles and of smaller size than the articles being processed, then continuing the tumbling operation in the same receptacle while simultaneously discharging said particles therefrom so as to initially separate the particles from the articles and the tumbling elements and effecting the subsequent treatment of the articles by the tumbling elements alone after the particles have been discharged.

Plated Engine Cylinder

U. S. Pat. 2,359,700. R. E. VanDeventer, assignor to Packard Motor Co., Oct. 3, 1944.

The method of fabricating an engine cylinder assembly which includes a steel cylinder and a separately formed steel water jacket containing nickel and chromium in sufficient amounts to render the same corrosion resistant, comprising depositing a continuous coating of nickel upon that portion of the outer surface of the cylinder which would, unless protected, be exposed to the action of a cooling fluid, depositing upon said coating of nickel a coextensive coating of cadmium, welding the water jacket in position on the cylinder so as to envelop the coated surface thereof, and thereafter heating the assembly to a temperature sufficiently high to allow the cadmium and nickel and relieve the stresses in and adjacent the weld which have resulted from the welding operation.

Notes on Industrial Health Hazards

(Concluded from page 675)

is better to send the scrap to the anode supplier, who has satisfactory equipment and knows how to process it.

It is common to heat cadmium plated parts in an oven for the purpose of eliminating hydrogen embrittlement. Such heating requires careful temperature control to the end that cadmium fumes are not formed in the process. Care should be taken that the specified temperature be not exceeded in any part of the oven.

Industrial accidents have recently occurred from welding operations carried out on cadmium coated articles.

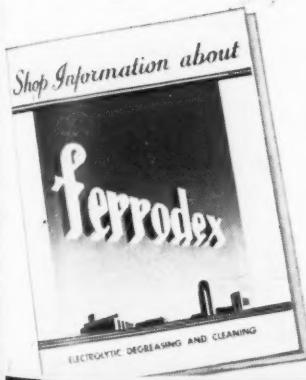
Where cadmium fumes are evolved and space limitations do not permit the use of sufficient ventilation, workmen should be supplied with positive pressure masks. Where acid fumes are also present in the atmosphere, a soda lime cartridge may be attached to the respirator.

There is no record of any cadmium poisoning caused by handling of cadmium plated parts; for example, on the assembly line. It is, of course, wise precaution to wash the hands before handling food.



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SHOP PROBLEMS

PLATING AND FINISHING
POLISHING — BUFFING
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HOT DIP FINISHES

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Plating on Plastics

Question: We would like to have outlined to us a satisfactory commercial method of plating on plastics. The adhesion is too poor with the experimental methods we have tried. The final plating required will be silver, but the initial plating can be copper or any other satisfactory metal.

We will deeply appreciate any information you may give on this subject, or any references to other authoritative sources where we may obtain additional information.

References to magazine articles covering this subject will be gratefully received.

J. L. W.

Answer: The adhesion is never very good unless the shape of the article is such that a mechanical bond is formed.

We are publishing an extensive survey of this subject starting in our September issue, and we would suggest that these articles be followed for details.

Stripping Tin from Brass

Question: We are faced with the problem of stripping tin plate from brass. Due to the fact that we have such a large number of pieces to strip, the hydrochloric acid and antimony oxide solution as recommended in the Plating Guidebook is not rapid enough. We have also tried stripping the tin by making the work the anode in an alkaline solution. This not only is very slow but also attacks the brass.

It may be possible that your organization may have developed a method for removing tin from brass that would act more rapidly. We will appreciate any suggestion that you can give us in order to overcome this difficulty.

E. W. M. CORP.

Answer: Ritzenthaler & Doyle have suggested the following solution which removes tin from copper alloys very rapidly and with very little attack on the basis metal:

Ferric Chloride 10-14 oz./gal.
56% Acetic Acid 40-60 fl. "

Copper Sulfate 18-21 "

When the action slows down, the iron may be reoxidized with hydrogen peroxide.

Cadmium Strip

Question: I am using a sodium cyanide strip for removing cadmium from steel propeller hubs. The strip is very successful for

a short period and then it ceases to work, either from the strip being saturated with metal or from an unknown reason and I have to dump the strip and make a new one. At the cost of cyanide today it makes the operation quite expensive. Is there any way that I can fix the old solution that it will continue working?

I would like to find a formula for bright-dipping sterling silver, a solution that would remove oxidation and also leave it bright.

S. P.

Answer: In connection with your cadmium strip, we would advise that you check for cyanide content to see whether the cyanide is decomposing. We would also suggest that you investigate the use of ammonium nitrate solution in the concentration of 1 lb. per gal. for stripping cadmium from steel. This solution is used at room temperature without current, and although it does not act very rapidly, it has absolutely no effect on the steel part.

A satisfactory bright dipping solution for sterling silver will be a 20% solution of sodium cyanide in water to which is added about 20% by volume of 30% hydrogen peroxide. This dip is very unstable, and should be made only in small quantities for immediate use.

Coloring Silver Brown

Question: I have to make some post-war samples. I must oxidize a silver plated article with designs, but with a light brown background instead of black. Please give me an idea as to how I can produce this finish.

A. A.

Answer: The following formulas may be tried:

1. (Krause):

Copper sulfate	100 grams
Ammonium chloride	50 "
Acetic acid	1 liter

2. (Langbein):

Copper sulfate	10 oz./gal.
Potassium nitrate	5 "
Ammonium chloride	10 "

3. (Hiorns):

Barium sulfide	1/3 oz./gal.
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4. Immerse for a few seconds in 40° Baume ferric chloride solution. Rinse carefully and immerse for about fifteen seconds in contact with pieces of zinc in a solution

of 20 g./L. caustic soda. This reduces the silver chloride, which is formed in the first dip, to brown metallic silver. (Krause.)

14K Color Gold Plating

Question: I have just returned to work as a plater after two years in another field and would like to continue receiving the Plating and Finishing Guidebook plus your monthly magazine. I also would appreciate your informing me as to the correct formula for 14 K. cyanide gold solution and the formula for a clean bright brass that can be operated at 140° without turning red like copper.

R. B.

Answer: For 14K. color gold plating the following solution may be used at 140° F. 3.5 volts, stainless steel anodes:

Sodium cyanide	2 oz./gal.
46% sodium gold cyanide	1/2 "
Nickel cyanide	1/10-1/5 "
Copper cyanide	1/30 "
Soda ash	1/4 "

As per your request, we are enclosing subscription blank for *Metal Finishing*, and we would advise that the 1943 edition of the *Plating and Finishing Guidebook*, which you will receive with your subscription contains solution and operating conditions for brass plating.

Cobalt Plating Bath

Question: We would appreciate receiving the following information on cobalt plating bath:

1. Best formula to use for plating brass parts.
2. Correct cleaning procedure prior to plating.
3. Current density.
4. pH (acidity) of bath.
5. Length of plating time.
6. Cause of burned edges when plating with a low current.

E. N. W. Co.

Answer: The Kalmus bath is the one which is generally recommended for cobalt plating and contains the following:

Cobalt sulfate	68 oz./gal.
Sodium chloride	2.3 "
Boric acid	6.0 "

The cleaning procedure is the same as for nickel plating. The current density may range from 30 to 160 amp./sq. ft. The pH should be maintained at 5.9 colorimetric. At a current density of 20 amp./sq. ft. cobalt will be deposited at the rate of 0.001" per hr.

Burnt edges when plating with low current usually indicates incorrect solution composition such as low metal content or operation at too low a temperature.

**REJECTS
CUT
FROM
50%
TO UNDER
2%**

**WHEN
NON-CORROSIVE
DC NO. 52
IS USED AS A
LUBRICANT
IN
DROP HAMMER
OPERATIONS**

**HELP WANTED?
JUST CALL A**



In the aviation industry many aluminum parts are formed by a drop hammer which gradually hammers a sheet of aluminum into the desired form. So as not to have too many edges torn, a lubricant is needed to help the metal "flow" into the lower cavity of the die.

Many lubricants have been developed . . . some heavy oils, others in paste form . . . but most have one fault in common. They are corrosive to aluminum and the parts therefore have to be washed and cleaned within four hours to avoid rejection.

Several aircraft manufacturers have been using Diversey DC No. 52 as a lubricant for drop hammer operations for over a year and with excellent results.

In some difficult operations rejections as high as 50% were not uncommon . . . subsequently were reduced to less than 2% with DC No. 52. Even deep draws up to 6" and corners of small radius offer no difficulties with DC No. 52.

In most cases DC No. 52 is used straight and simply applied to the required spots with a brush. Since DC No. 52 is non-corrosive the parts can be cleaned days or even weeks later if desired. For cleaning only a strong hot water rinse is needed; DC No. 52 is water soluble. For liberal experimental sample and further details write

Metal Industries Department
THE DIVERSEY CORPORATION
53 W. Jackson Blvd., Chicago 4, Illinois

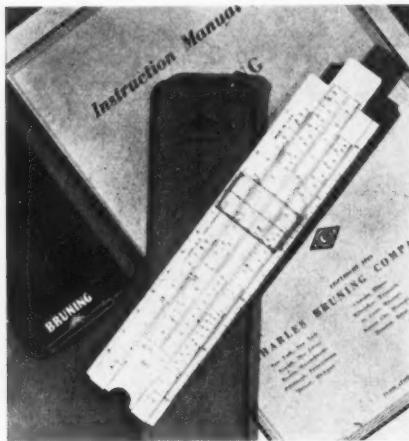
NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

Slide Rule

To fill the need for a high-precision, high-quality pocket slide rule which could be offered to engineers at a moderate price, the Charles Bruning Company, Dept. MF, New York and Chicago, has just announced its new Bruning 2401, 5-inch Pocket Slide Rule.

In introducing this slide rule, the company



stresses the fact that this is not a "duration substitute," but rather a carefully made, smooth-working precision instrument designed for fast, easy operation.

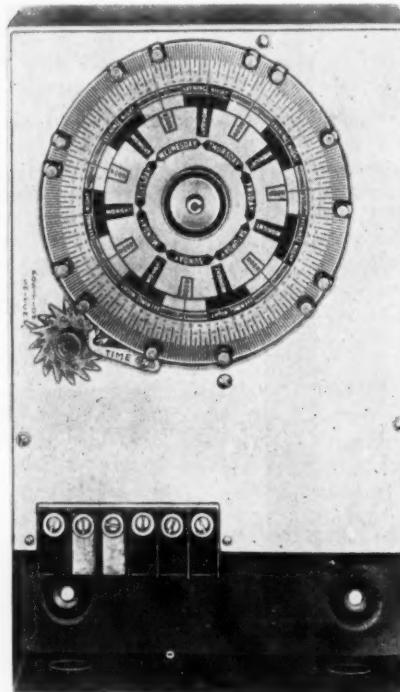
A notable feature of the slide rule is the precision of its graduations. These graduations, being molded in, are an integral part of the rule—will not lose visibility through use. Graduations and numerals of the CI scale are in red to facilitate reading. Three screws in the back of the rule provide a simple adjustment for tension on the slide. The indicator is of glass and is easily replaceable in the event of breakage. This indicator is enclosed in a frame of stainless steel that holds it firmly in place and elimi-

nates "wobble." A, B, CI, C, D, K, S, L and T scales are shown on the rule in order to adapt it to the widest possible range of service. The beveled edges of the rule are in graduated scales of both inches and centimeters.

Officials of the company say the slide rule will sell for under \$4.00, complete with natural leather case and instruction booklet.

Time Switches

A significant development in time switches is the Paragon 700 Series 7 day calendar, dial time switch. This unit has demonstrated its worth for timing automatic heat, ventilating,



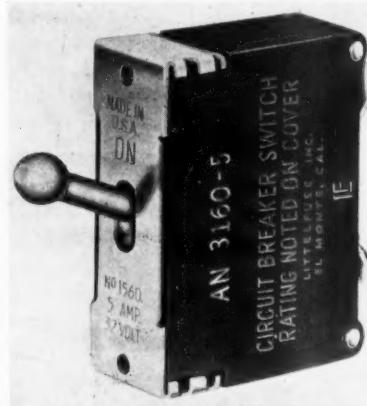
lighting, pumping or flushing operation. These switches are equipped with 6" calendar dials which make one complete revolution every 7 days. Dial trippers can independently set for different daily ON and OFF schedules. Settings can be made advance for an entire week. Any day's operations may be omitted entirely or a pre-set program.

Each day of week clearly separated from other days; graduated into hours and half hours; day and night distinctly separate. Operations from ON to OFF or from OFF to ON can be set as close as three hours apart and can be separately adjusted throughout each 24 hour day in the week.

Engineering bulletin available from Paragon Electric Company, Dept. MF, 39 W. Van Buren St., Chicago 5, Ill.

Circuit Switch Breaker

A new circuit breaker relatively free from the effects of extreme high and low temperatures is announced by Littelfuse Incorporated, Dept. MF, 200 Ong St.,



Professional Directory

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SPECIFICATION PLATING**
A. ROBINSON & SON
131 Canal St., New York
Telephone CANal 6-0310
64 Years in Precious Metals

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Consulting Chemical Engineers**

SALT SPRAY TESTING — CERTIFIED TO MEET ARMY AND NAVY SPECIFICATIONS. Testing of deposits-thickness, composition, porosity. Solution analyses, plant design, process development.

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Complete services, including solution analyses, process development and deposit tests.
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War plating plants designed and streamlined for increased production.

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SERVICE FOR THE METAL FINISHING
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RE-CONVERSION AND PREPARATION FOR
PEACE-TIME PRODUCTION: — SPECIALIZATION

KEYSTONE METAL-GRAPHITE *Brushes* For **Maximum Efficiency**



KEYSTONE Metal-Graphite Brushes for low voltage generator and slip ring applications are designed to improve operating conditions for maximum efficiency. Keystone Brushes embody the more recent requirements of higher current carrying capacity, less friction and lower operating costs.

Their high conductivity, good commutation and long life assure dependable electrical energy at all times.

Keystone Metal-Graphite Brushes, with copper and graphite carefully proportioned for the requirements of the individual piece of equipment, have ex-

cellent lubricating qualities. The shunts, which are molded directly into the brush, establish a perfect connection.

Brushes are carried in stock for standard makes of equipment and can be delivered promptly. Keystone's Research Department and experienced engineers are prepared to assist you with recommendations for particular applications.

*Write for catalog and
price list K-15 today.*

KEYSTONE CARBON COMPANY, INC.

Manufacturers of Precision Molded Products
1935 STATE STREET, SAINT MARY'S, PENNA.

Monte, California and 4757 Ravenswood Ave., Chicago 40, Ill.

The actual trip temperature of the new breaker without flow of current is 350° F., ambient temperature. This outstanding resistance is accomplished by new bi-metal design.

In the Littelfuse, the bi-metal is used as the finger that pulls the trigger. No appreciable mechanical load is exerted on the bi-metal as it trips the breaker. A new degree of dependability and uniformity of performance is obtained.

The Littelfuse switch breaker No. 1560 (AN 3160) is of switch type, non-trip free, performance specification AN-C-77.

The range is 5 to 50 amperes at 32 volts, AC or DC. It is capable of breaking 2500 amperes on short circuit. It easily meets the requirements of holding for one hour at 115 per cent of rated current; breaks within the hour on 138 per cent of rated current; breaks at 200 per cent of its load between 10, and 100 seconds. These tests are all at the ambient temperature of 77° F. ± 1.8° F.

Electrolytic Brush

A new, improved Electrolytic Brush, used in conjunction with the Warner Electroplating Compounds, has now become available for peacetime production. With the coopera-



tion of DuPont, it was developed by the Warner Electric Company, Dept. MF, Chicago 1, to solve specific electroplating problems encountered in the manufacture of special war equipment.

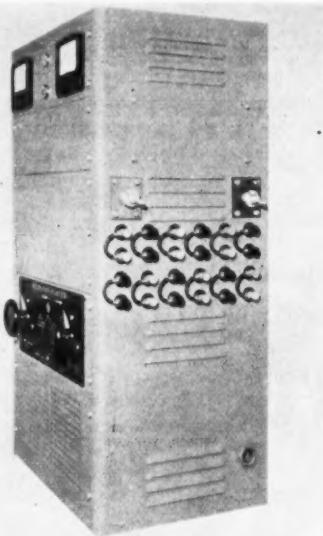
The new brush and process are now being employed in an increasing number of industrial applications. This method has proved practical and demonstrated its usefulness in decorative work, maintenance, and in the salvaging of tank-plated rejects. A company's name or trade-mark may be electroplated on the article being manufactured. The conductivity of electric switch contacts, blades and jacks may be improved or renewed without disassembly. Dies and shafts may be also plated and renewed when worn.

Warner Electroplating Compounds are available in gold, silver, nickel, copper, cadmium and chromium. Folder describing *Electroplating by Brush* available on request.

Multi-Rectifier

Research and development laboratories which have heretofore faced diverse and difficult problems with regard to D.C. power supplies have a distinct asset in the newly developed Multi-Rectifier by the Green Electric Laboratories, Dept. MF, 130 Cedar St., New York 6, N.Y.

This single unit, a complete departure in terms of flexibility, allows for a range of



from zero to forty-eight volts in a compact mechanism. Engineers and technicians will no longer be handicapped in their development work by the limitations now imposed upon them by orthodox rectifiers, generators or batteries.

This new Multi-Rectifier incorporates six selenium rectifier sections which may be interconnected by external links to provide four ranges of D.C. power:

0.8 volts, maximum capacity 100 amperes.
0.16 volts, maximum capacity 50 amperes.
0.24 volts, maximum capacity 35 amperes.
0.48 volts, maximum capacity 18 amperes.

Thus it is possible for the two panel-mounted voltage control switches to provide a range of control in 49 steps, from zero to maximum, on any range. The built-in voltmeter and ammeter indicate the D.C. output voltage and current at all times, and red line calibrations indicate the maximum current limitation on each range.

On each side of the cabinet of the new Multi-Rectifier, wing nut terminals are duplicated for convenience in connecting loads. The section binding posts for interconnection are externally located on the right hand side only.

Additional features include a three phase magnetic contactor in the main power supply circuit with ON-OFF push buttons, pilot lamp, Monitor lamp, buzzer (overload warning), and Automatic Watchman which provides automatic current interruption in case of prolonged overload.

The Multi-Rectifier is available for operation from 220 to 440 volts or as specified at 60 cycles.

Vise-Wrench

A new, improved Vise-Wrench is announced by Knu-Vise, Incorporated, Dept. MF, De-

troit 16, Mich. Being made of alloy steel forgings, properly heat treated, the mill teeth, welded to the stamped body (also heat treated) are said to possess added wear resistance.

This tool has wide versatility. It can



used as a portable vise to hold work for numerous operations such as drilling, welding, riveting, soldering, grinding, etc., or a pipe wrench.

Standard Spray Cleaning Machine

The Optimus Equipment Co., Dept. V, Matawan, N.J., has designed a new hot spray type cleaning machine which is specially adapted to the cleaning of large, heavy parts. The machine is portable and of any cleaner. As it is operated closed, there are no fumes or unpleasant odors. The work is washed and rinsed in the same compartment, but the waste water drains into a sewer, and does not contaminate the station. It is adaptable to any low cost, convenient heating system with optional thermal control and insulation.

In principle, the machine consists of a sturdy tank with cleaning door drain and thermometer, water inlet cock and filter.



basket. The parts are handled by an overhead track and carriage and are lowered in a flat grille or rack or in a basket. Hot cold solution is pumped through the spray nozzles fastened on rocking frames so as to reach all surfaces of the work. All working parts are easily removable for cleaning or repair.

The machine may be used for any dipping operation: washing, rinsing, pickling, passivating, rust-preventive coating, etc. It is available in a variety of sizes, and is particularly suited for Diesel and automotive engines, motors and other heavy work.

The machine uses only a small quantity of cleaning solution. Consequently, the cost of operation is low, about 25¢ per hour, both heat and power for medium size machines.

PUT *Beckman* pH CONTROL TO WORK IN YOUR PLANT

1. INCREASING PLATING SPEEDS
2. REDUCING COSTLY "REJECTS"

3. PRODUCING SMOOTHER COATINGS
4. IMPROVING PLATING EFFICIENCIES

By Beckman-controlling the pH of your plating processes you can make FOUR important savings in your plant operations . . . vital savings that mean higher quality platings at substantially lower operating costs . . .

1. By closely controlling the pH of your plating baths you can generally operate at higher current densities without risk of faulty coatings. This means faster plating, reduced costs. *And remember—Beckman is the only pH equipment that will accurately control alkaline plating operations such as cadmium, zinc, brass, etc.!*

2. The controlled-coatings produced by Beckman-regulated plating baths minimize blistering, peeling and off-color deposits, thus greatly reducing "rejects" and costly waste of time and materials.

3. Not only are blistering and peeling practically eliminated, but Beckman-controlled coatings are far more uniform and smoother, insuring highest quality platings on run after run.

4. And because Beckman-controlled plating processes are simple to handle and uniformly effective at all times, even inexperienced plant workers can turn out consistently top-quality plating jobs with minimum loss. Over-all plant efficiencies are greatly increased!

LET US HELP YOU take full advantage of the multiple savings possible through Beckman pH Control.* Our engineering staff will gladly make recommendations to fit your particular requirements.

**NATIONAL TECHNICAL LABORATORIES
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WORLD'S LARGEST MANUFACTURER OF GLASS ELECTRODE pH EQUIPMENT

Beckman THE LEADING NAME IN pH



The Beckman Automatic pH indicator is the most advanced pH instrument available today. Incorporates many unique features found in no other make or type of equipment. Operates standard control and recording equipment. Ask for Bulletin 16!



The Beckman Industrial pH Meter is ideal for portable plant and field use. Simple, quick, accurate. May be used with Beckman Flow Type and Immersion Type Electrode Assemblies for maintaining pH check on solutions in process. Ask for Bulletin 21!

SEND FOR YOUR COPY OF THESE HELPFUL BECKMAN BOOKLETS!

"What Every Executive Should Know About pH"—a simple, non-technical discussion of what pH is, how it's used, and its importance to modern industrial operations.

Bulletin 86—The most complete catalog available on modern pH equipment. Lists and describes over 60 different electrodes together with accessory equipment for all types of applications.



IT'S EASY
TO PEEL
OFF!



UNICHROME *

"QUICK DRY"
STOP-OFF 323

for extra resistance . . . less work in handling

You won't have to waste valuable time removing Unichrome Stop-Off 323 from plated work. This tough, stop-off lacquer has the mechanical strength to permit quick peeling off—at room temperatures. Besides being easily removed, Unichrome Stop-Off 323 is easily applied by spraying, dipping or brushing—and fast-drying! It cuts cleanly at the edges, and adheres firmly throughout the general run of plating baths.

Because in compounding Stop-Off 323 we use special resins that are closely restricted by W.P.B., you may not get all you want immediately. So specify Unichrome Stop-Off 323 now. Start getting its extra convenience and speedy handling as soon as possible. Write the nearest office for your trial order.

* Reg. U. S. Pat. Off.

UNITED CHROMIUM, INCORPORATED

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PROPERTIES

Chemical Resistance—Excellent in all plating cycles.

Application—Can be brushed or dipped—successive coating is minimized.

Drying—Dries quickly at room temperature—adheres without force drying.

Stripping—Removed from work with utmost ease when the plating is over.

TRY THESE OTHER UNICHROME MATERIALS

Unichrome Quick Dry Stop-Off 322—
for cyanide copper and other plating work requiring an extremely adherent stop-off.

Unichrome "Air Dry" Rack Coating—a

rack insulation that can be dipped and dried at room temperature, for use in all plating solutions.

Unichrome Coating 202—a new rack insulation similar to "Air Dry," but which is force dried to obtain the extra adhesion required in anodizing and hot, strongly alkaline solutions.

Unichrome Resist—a solid insulating material for constructing composite racks, stop-off shields, insulating gaskets, etc.

Water Soluble Metal Cleaner

The Phillips Chemical Company, Dept. MF, West Touhy Ave., Chicago, Ill., announces "Swirt," a new addition to their line of Controlled Cleaning chemicals. Swirt is a powerful emulsifying cleaner that is entirely harmless to the worker and the work. It acts efficiently upon all types of soil: grease, buffing compounds, cutting and machining coolants and oils, and is equally effective upon ferrous and non-ferrous metals.

An added feature is that Swirt gives off no dangerous or disagreeable vapors to injure or annoy the operator; in fact, it is practically odorless. Being neither acid nor alkaline it will not etch or pit and can safely be used on the most sensitive metals and

alloys. Fire hazards are reduced because of its high flash point (155° open cup).

This cleaner may be used in practically any sort of container, from a bucket to a thermostatically controlled heating tank or degreaser. Its operation is simple: merely rinse in Swirt and flush with plain water.

In use the cleaner is economical since it does not dissipate readily by evaporation and it stays clean longer because most of the soil and grease is carried off in the water rinse.

Its versatility suggests many other uses. In automatic washing machines Swirt is effective in very weak dilutions; for equipment maintenance it may be used as a spray and has had many successful applications clean-

ing airplane, truck and Diesel motors, both inside and out, on the chassis. It may be blown dry with air or hand wiped. Manufacturer offers a circular with more information.

Ball Bearing Cleaning Machine

The new L & R Precision Ball Bearing Cleaning Machine combines the already famous L & R rotary principle with a new pressure cleaning mechanism.

In the basket of the rotary cleaner, from fifty to one hundred bearings of various sizes may be pre-cleaned. In the pressure cleaning tank, continuously filtered solution under



six to ten pounds of pressure is forced through each bearing individually. Filtered compressed air is provided to remove surplus solvent from the bearing while it is still on the pressure cleaning spindle. The result is a perfectly functioning unit. The solvent used is L & R Instrument Rinsing Solu-

The bearing on the pressure cleaning spindle is rotated alternately clockwise and counter-clockwise to obtain maximum surface coverage by the solvent. The coned head into which the bearing fits to receive the cleaning compound is stepped to accommodate eleven sizes of bearings up to 2" O.D. This unit is standard; others can be made to conform to sizes of bearings according to individual specifications.

The tank in which the pressure cleaning mechanism is located is sealed during operation. The process may be observed through the glass lid with visibility aided by a plastic hooded lamp located within the tank, opposite the spindle.

With minor changes the machine can be adjusted to clean gears and other small assemblies with or without ball bearings.

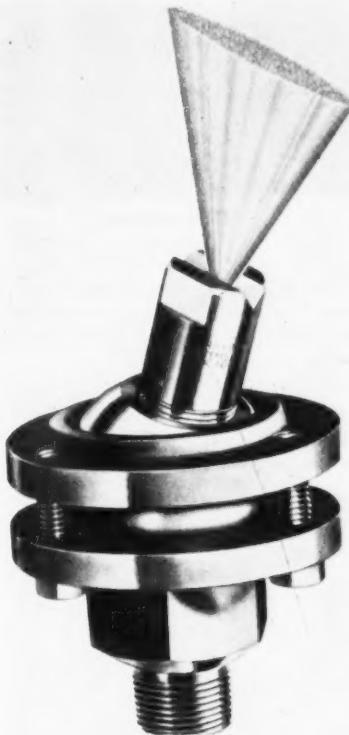
The basket of the rotary cleaning unit measures 5½" ID x 3¾" deep. Total weight of machine is under 200 pounds. Current 110 V., AC. All controls are mounted on a single panel located at the front of the machine. The equipment is fitted complete with casters so that it may be moved at any point in plant.

Complete catalog information and quo-

ors, but
may be
Manu-
re info-
rations are available from the L & R Manufacturing Company, Dept. MF, 577 Elm St., Arlington, N. J. Demonstrations may be arranged at that address or in their Chicago office at 50 E. Washington St., Chicago 2, Ill.

Spraying Systems Adjustable Joint

The new Spraying Systems adjustable joint, because of new ball and socket design, provides a full 50° nozzle adjustment range in any plane at right angle to the face of the joint. The thick socket plates permit an unusually strong friction grip, more than sufficient to hold the nozzle in fixed position, no matter how extreme the spraying operation. Three machine screws are quickly turned to adjust the joint as required. Illustrated is the adjustable joint with a "Veejet"

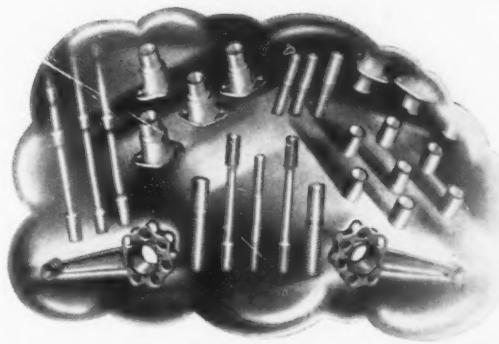


flat spray nozzle mounted in the socket. This adjustable joint is made in brass or steel as standard, but may be had in a variety of special steel alloys as required. Various sizes of joints with standard pipe thread can be furnished, such as $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ " and 1". Adjustable joints of this type have already been tested and proved. Typical applications are found in equipment for washing, rinsing, and paint flow-coating. For detailed information write Spraying Systems Company, Dept. MF, 4039 West Lake Street, Chicago 24, Ill.

Polishing Wheel Cement

Michigan Bleach & Chemical Company, of Detroit, has announced a new synthetic polishing wheel cement, "Gripmaster."

To enable polishing plant executives and superintendents to test Gripmaster Polishing Wheel Cement on their own jobs, the makers of Gripmaster will gladly send a full



**THE
ANTI-RUST
OIL**
**Developed and
Manufactured by
Experienced
Platers**

for PLATING PLANT USE

Miccroil is an all-purpose high flash anti-rust oil. However, it was developed in the Michigan Chrome and Chemical Company laboratories primarily as an oil that would provide proper protection against the corrosive atmosphere prevalent in plating plants.

In the many plating plants where it is now used, metal parts covered with Miccroil have resisted corrosion and oxidation where the relative humidity has varied from 92% to 96% and temperatures have been between 85° F. and 90° F. It has proved most useful in selective plating, where portions of the part have been plated and the non-plated areas must be protected from corrosion immediately after the plating cycle is completed.

Full information on this oil which meets fully every requirement for plating plant use is yours for the asking.

Provides These Outstanding Advantages

HIGH FLASH POINT
Possibility of fire hazard reduced to minimum.

LIGHT IN COLOR
Does not alter appearance of part on which it is applied.

UNIFORM COVERAGE
Assures uniform and effective protective film over entire surfaces.

NEVER BECOMES RANCID
Contains no ingredients which produce rancid odor.

MICCROIL

MICHIGAN CHROME & CHEMICAL CO.
6348 EAST JEFFERSON • DETROIT 7, MICHIGAN

flat spray nozzle mounted in the socket. This adjustable joint is made in brass or steel as standard, but may be had in a variety of special steel alloys as required. Various sizes of joints with standard pipe thread can be furnished, such as $\frac{1}{8}$ ", $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ " and 1". Adjustable joints of this type have already been tested and proved. Typical applications are found in equipment for washing, rinsing, and paint flow-coating. For detailed information write Spraying Systems Company, Dept. MF, 4039 West Lake Street, Chicago 24, Ill.

gallon sample, free and without obligation, to any company writing on their letterhead.

An important time-saving and inventory-reducing advantage of Gripmaster, on which a patent is now pending, is that all grains—250 to 20—may now be applied with just one grade of cement. It is now no longer necessary to stock several different grades of adhesives for different metals, different flexibilities or different temperatures. Gripmaster's one grade fits them all.

Users report that it is even possible to oil out with Gripmaster, an operation that formerly required a special adhesive. Nor is a special sizer necessary. With the addition of water only, Gripmaster serves as its own sizer.

Thorough plant tests devoted to the special problem of drying have established that Gripmaster dries quickly at room temperature.

Plants making these tests report that they find that the extra oven-heating operation can now easily be dispensed with.

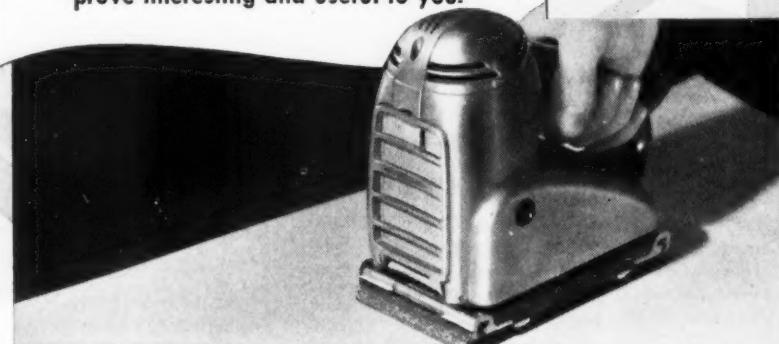
Complete information, together with a generous free sample of Gripmaster, may be obtained by writing Michigan Bleach & Chemical Company, Dept. MF, 1944 E. Woodbridge, Detroit 7, Mich.

Correction

Due to an error in printing the October issue, under "Copper Process" on page 626, the address of The Promat Division, Poor & Co., was given as Cincinnati, Ohio. The correct address is The Promat Division, Poor & Co., Dept. MF, 851 South Market St., Waukegan, Ill.

Ingenious New Technical Methods

Presented in the hope that they will prove interesting and useful to you.



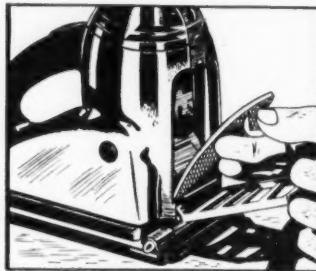
No Vibration in New "Orbital Action" Portable Electric Sander; Relieves Workers' Fatigue

A boon to workers' nerves and health, this new "Orbital Motion" electric sander is actually vibrationless. A great saver of workers' energy as well as man-production hours, the sander can be operated easily in horizontal, vertical or inverted position with one hand. Compared to manual sanding, this machine achieves superior results at least eight times faster. It performs equally well on wood, metal or plastics.

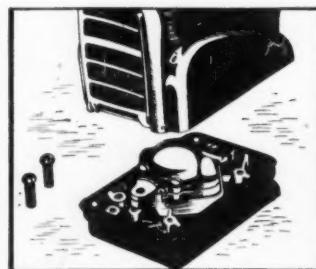
Developed for war industry, this revolutionary new sander has done yeoman duty in this country's manufacturing plants and in allied maintenance and repair depots all over the world.

Wrigley's Spearmint Gum renders a real service to workers too—eases dry throat and relieves tension that brings on fatigue, leaving both hands free to stay on the job. The Army and Navy were quick to appreciate these benefits, that's why they are now shipping to our fighting forces overseas only, our entire limited production of Wrigley's Spearmint. Just as soon as we can supply the home front, too, industry will again enjoy the benefits of Wrigley's Spearmint Gum now proving so important on the battle fronts.

You can get complete information from Sterling Tool Products Company, 155 East Ohio Street, Chicago 11, Illinois



Easily-removed filter cleans air that cools motor—prolongs motor life and reduces maintenance costs.



Dustproof transmission synchronized to eliminate vibration. Oil supply lubricates for 100 operating hours.

Y-160

Business Items

W. D. MacDermid Chemical Company has awarded a contract to the Yoos Construction Co. for the erection of new buildings at its present site at Plymouth, Conn. This expansion will increase floor space by 50%. In addition to the extra manufacturing and warehousing space the plans include a new, modern chemical and testing laboratory. Equipment will be installed to handle the processing of all work samples and solutions. A new design of unloading ramp has been installed whereby incoming carloads of raw

materials may be handled without interference with the present shipping and receiving department.

The company also announces the appointment of Mr. C. A. Kohrs as sales and service engineer. Mr. Kohrs will serve the Massachusetts and Rhode Island territory with headquarters in Worcester, Mass. Mr. Kohrs leaves the Union Hardware Co. of Torrington, Conn., after 12 years as finishing supervisor. He is a member and a past president of the Hartford Chapter of the A.E.S.

Wilfred S. McKeon, president of Sulphur Products Co., Inc., Greensburg, Pa., is vacationing in Miami, Florida.

Miss M. F. Hennessey, treasurer of The Puritan Manufacturing Co., in Waterbury, Conn., manufacturers of polishing and cleaning compositions, has announced the ap-



Victor Michaels

pointment of Mr. Victor Michaels as Field Service Engineer. Mr. Michaels, who was formerly with the Diversey Products Company, will cover the New Jersey and Pennsylvania area.

Definitely planning for post-war, James H. Rhodes and Company has doubled its representation in the Detroit area where they have operated for over thirty years. The new



R. B. Sullivan

S. Stanton

representatives are: R. B. Sullivan and S. Stanton.

Well known for industrial polishing products, James H. Rhodes and Company has made tremendous headway in manufacturing and merchandising its lines of sponges, chamois, steel wool, felt wheels, polishing felts, industrial felts, pumice and abrasives. The Detroit office is located at 215 Machinery Bldg., 2832 Grand Blvd.

Dunham Craft, Inc., Thomaston, Conn., has been formed to engage in gold plating to specification, using a process claimed to be their own development and adaptable to both bulk and still tank plating, with speeds approaching common base metal deposition.

R. O. Hull has announced the establishment of his own business, to be known as *R. O. Hull and Company*, 1279 West 3rd St., Cleveland, Ohio, for the manufacture of



R. O. Hull

electroplating chemicals and specialties. Although Mr. Hull has left the direct employ of the *Du Pont Company* after 11 years as research supervisor, he will continue with them as part-time consultant for several months.

More than one hundred men of the nationwide field organization of the *DuBois Company* convened at the Hotel Stevens in Chicago on October 12th for an intensive three-day discussion of the newer metal cleaning and degreasing processes with special emphasis on post-war metal working applications.

In addition to the educational program prepared by the DuBois Chemical Engineers, specific case histories were analyzed, based on "before and after" displays of assemblies processed with DuBois products. These displays were contributed by leading war plants, ordnance plants and rubber manufacturers in appreciation of the production increases made possible through the use of DuBois products.



George R. Young

UNICROME*

COATING 202

Protects racks longer during severe plating cycles

PLATING SOLUTIONS that run riot with ordinary insulations have a hard time affecting Unichrome Coating 202. It's especially formulated for force drying that gives it utmost resistance to strongly alkaline solutions . . . longer life in anodizing baths . . . greater adherence in harsh cycles. Tested under actual shop conditions, this coating utilizes special resins that develop maximum chemical resistance.

As you might guess, these resins are currently restricted to war uses—but that hasn't changed our formula in the slightest. So get going on longer rack coating life by ordering a trial shipment today. Write for information and prices to the nearest office.

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PROPERTIES

Chemical Resistance—Excellent for all plating cycles.

Toughness—Withstands repeated flexing and shop handling—cuts cleanly and easily at contacts.

Drying—Dipped at room temperature in container in which it is shipped—force dried at 200°F. for extra protection.

Adherence—Excellent for severe cycles. For moderate cycles "Air Dry" coating is recommended.

TRY THESE OTHER UNICROME MATERIALS

Unichrome "Air Dry" Rack Coating—a rack insulation that can be dipped and dried at room temperature, for use in all plating solutions

Unichrome Quick Dry Step-Off 322—

for cyanide copper and other plating work requiring an extremely adherent step-off

Unichrome Resist—a solid insulating material for constructing composite racks, step-off shields, insulating gaskets, etc.

The *George L. Nankervis Company* announces the addition of Donald C. Hulse as Designing Engineer and George R. Young as Service Engineer.

Mr. Hulse has a fine reputation as a specialist in the design of anodizing and plating racks and fixtures. He is also responsible for the design of many of the finest plant layouts in this area. Mr. Hulse was formerly assistant to the plant engineer of the DeSoto Division of the Chrysler Corporation where he supervised design and installation of metal finishing equipment. He was previously in the engineering department of Great Lakes Steel Corporation.

Mr. Young is a graduate mechanical engineer, and has had a broad experience in the design and fabrication of heating, ventilating and conveyor systems for metal finish-



Donald C. Hulse

BUNATOL



In the BUNATOL line there is a rack insulation for every possible application.—engineered to give more and better service than expected. No. 720 is the new number designed to stand up in strong alkali; good in acid solutions too. Ideal for decorative plating.—Zinc, Tin and Cadmium. No. 160 is the outstanding insulation for anodizing racks. For plating Stop-Off there is a BUNATOL number that is "tops" for the particular application.

May we submit samples? No obligation.—just outline your needs and we will gladly submit sample of the right material to give you better service at lower cost.

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ing plants. Early in his career he was vice-president and treasurer of the Schweitzer Engineering Company, Detroit, leaving that position to become assistant to the plant engineer at the Plymouth Division of the Chrysler Corporation in charge of metal finishing activities.

The George L. Nankervis Company is located at 5408 Commonwealth Avenue in Detroit.

A. Harry Sanders of New Britain, Conn., joined Enthon Company on October 15 to become a sales engineer. He will work throughout Northern Connecticut and West-

ern Massachusetts in servicing Enthon customers.

He graduated from Trinity College in 1937 with a B.S. in chemistry. After graduation, he spent five years in the Research Laboratory of Underwood, Elliott, Fischer Co., Hartford, Conn., as a plating chemist. From 1942 to October 15, 1944, he was Finishing Superintendent of North & Judd Mfg. Co., New Britain, Conn. He is a member of the American Electroplaters' Society.

John W. Sands, who has been with the Conservation Division of the War Production Board at Washington, D. C., since January,

1942, has resumed his duties with the Development and Research Division of *The International Nickel Company, Inc.*, at New York. T. H. Wickenden, manager of that division of the company, announces.



L. K. Lindahl

According to L. K. Lindahl, president, *The Udylite Corporation*, Detroit, Mich., will celebrate this month the completion of twenty-five years of activity in the field of metal finishing.

Mr. A. J. MacDermid, president of *MacDermid Incorporated*, Waterbury, Conn., announces the following appointments:

Mr. Harold Leever as vice-president of the company; Mr. Arthur McNeil as technical sales engineer for Southern New England. Mr. McNeil was formerly with the Contract Plating Company and Bridgeport Thermostat as finishing superintendent; Mr. Arthur Logozzo, who formerly serviced Southern New England, has been transferred to Hartford to cover Northern Connecticut and parts of Massachusetts, formerly covered by the late A. J. Maynard.

C. B. Stainback, manager of the Industrial Department of the *Westinghouse Electric and Manufacturing Company*, announced the appointment of B. M. Brown as manager of the Petroleum and Chemical Section.

Mr. Brown succeeds Q. M. Crater, who was transferred to the Detroit, Mich., office of the Industrial Department as assistant manager.

The new section manager joined Westinghouse as a member of the student course in 1941 and then served in the Machinery Electrification Section until 1943. During that year he left the company for a short time to work with the Pomona Pump Company, Pomona, Calif., but returned in December, 1943, to the transportation department and served there until his present appointment.

A native of Joliet, Ill., Mr. Brown attended the Joliet Township High School and received his Bachelor of Science degree in Electrical Engineering in 1931 from the University of Illinois.

The appointment of Mr. G. W. Onksen as manager of Industrial Engineering and Service of Solventol Chemical Products, Inc., of Detroit, was announced today by President Charles J. Campbell.

For the past 32 years, Mr. Onksen has



G. W. Onksen

been associated with various divisions of the General Motors Company. He comes to Solventol from the Guide Lamp Division, where he was supervisor of process engineering. He has also been active as safety director and leader in foreman training.

Mr. Onksen's headquarters will be at the main office of the company at 15841 Second Avenue, Detroit, Mich.

H. B. Higgins, president of the Pittsburgh Plate Glass Company, has been elected president also of the Pittsburgh Corning Corporation, replacing the late H. S. Wherrett, it has been announced.

R. L. Clause, vice-chairman of Pittsburgh Plate, was named vice-president of Pittsburgh Corning, which is owned equally by the Corning Glass Company and Pittsburgh Plate. R. B. Tucker, vice-president of Pittsburgh Plate, was elected to the subsidiary's board.

Pittsburgh Corning operates a plant at Port Allegany, Pennsylvania, manufacturing specialty glass such as Foamglas for insulation and glass blocks. Virtually all of its products are sold through Pittsburgh Plate Glass.

Amory Houghton, of Corning New York, chairman of Corning Glass, is chairman of Pittsburgh Corning; and Glen W. Cole, president of Corning, is vice-president of Pittsburgh Corning. J. P. Staples, of Pittsburgh, is secretary of the subsidiary and W. V. Simmons, of Pittsburgh, is treasurer.

Worthington Pump and Machinery Corporation has announced the appointment of William J. Van Vleck as manager of its Atlanta office, succeeding Edward Stauverman, who, after many years of association with Worthington, has resigned to engage in another line of business.

Mr. Van Vleck entered Worthington's employ in 1924 as a member of the student group. Since 1938 he has been assistant

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With two complete, independent plants at Jersey City and Baltimore, and its own supply of the basic raw material Chrome Ore from company owned and operated mines, Mutual is the world's foremost manufacturer of Chromic Acid.

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PLATING RACKS

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- Constructed without screws, rivets, solder, brazing, welding.
- We design racks to suit your individual problem.

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(Phone—Hollis 5-6871)

Factory: 147-24 Liberty Ave., Jamaica 4, L. I., N. Y.
(Phone—REpublic 9-7223)

manager of the Philadelphia district office. Prior to that assignment he was application and field service manager in the same district.

Acquisition of the *Mid-States Gummed Paper Company* of Chicago, one of the larger concerns in the field of gummed paper and cloth tape and gummed label manufacture, was announced by *Minnesota Mining and Manufacturing Company*, Saint Paul, through *W. L. McKnight*, its president.

Part of a diversification program begun several years before the war and resumption of which is contemplated in the post-war period, the transaction places Minnesota Mining and Manufacturing Company in two distinct fields of tape production. Originator of "Scotch" Tape and pioneer in the field of pressure-sensitive adhesives, the Saint Paul concern will now also engage in the manufacture of water-activated tapes and labels.

While the purchase price was not divulged, it is understood to be in the neighborhood of \$1,000,000. The acquisition brings to Minnesota Mining and Manufacturing Company 171,250 additional square feet of plant, office and warehouse space in the three-story property occupied by Mid-States at 2515 South Damen Avenue, Chicago, which has 270 feet of track frontage on the Burlington Railroad's right-of-way.

ADELE BRAUN

The many friends of *Al Braun*, president of *Agate Lacquer Manufacturing Company, Inc.*, 11-13 Forty Third Road, Long Island City, N. Y., will be shocked to learn of the death of his daughter *Adele*.

Adele had attended many A. E. S. conventions with her Dad.

We extend our deepest sympathy to Mr. and Mrs. A. Braun.

Courses in Electroplating

The *Institute of Electrochemistry and Metallurgy*, 59-61 East Fourth Street, New York City, is offering specialized courses in the field of electroplating and metallurgy during 1944-45. The first class was held on September 26. The following studies are offered.

Courses

Electroplating 1.

The course is designed to give the electroplater or industrial worker a foundation in chemistry including qualitative and quantitative analysis. One hour each evening will be devoted to class lectures in which will be discussed the theories of modern chemistry as applied to electroplating. The remaining hours will be devoted to the laboratory where the student will conduct his own experiments. Tuesday and Wednesday from 7:30

to 11:00 P. M., Dr. Young, Mr. Klinse and Mr. Bundy. Fee, \$45.00.

Metallurgy 1.

The student will be introduced to the structure of metals and alloys and factors are taken into account which affect these, such as temperature, mechanical working, etc. The application of the phase rule to physical metallurgy will be discussed. Both binary and tertiary systems will be studied and illustrated. Heat treating, surface treating and tests of metals and alloys will be studied. Tuesday and Wednesday, 8:30-9:30 P. M., Dr. Young, Mr. Klinse and Mr. Bundy. Fee, \$30.00.

Research 1.

This course is designed to give the practical electrochemist a chance to investigate problems in his field. One-half hour per week is devoted to a conference with the instructor in which the method of attack is laid out. The remaining time is spent in the laboratory where the student applies his knowledge and technique to solving of problems which arise in such an investigation. Tuesday and Wednesday, 7:00-11:00 P. M., Dr. Young. Fee, \$30.00.

Time payments may be arranged if desired.

For further information call Dr. C. B. F. Young, ORchard 4-1778 or FLushing 9-1685.

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For all parts regardless of shape. We specialize in your rack problem.

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Associations and Societies

American Electroplaters' Society

Waterbury Branch

Waterbury Branch of the A. E. S. held its regular monthly meeting on October 13, 1944 at the Hotel Elton. As usual dinner was served in the Colonial Room at 6:30 p.m. and the technical session of the meeting started promptly at 8 p.m.

Chromic Acid Anodizing was the topic for the evening's paper. Mr. L. G. Tubbs of Mutual Chemical Co. explained that the tremendous increase in the use of aluminum, particularly in airplane production, has caused large demands for this process. Chromic acid forms a film which inhibits further corrosion and makes an excellent base for paint. In addition it can be readily dyed and many aluminum parts are being given distinctive colors for the purpose of identification. Dial parts, instrument cases, and pieces where light reflection is undesirable are dyed a dense black in a nigrosine dye. The process is relatively simple and few controls are necessary.

After the war more household appliances will be made with aluminum and these will be especially adaptable to dyeing in various colors. Aluminum is now of course one of the most vital metals in the war effort so we can expect tremendous quantities are going to be available in the post war period for all kinds of domestic production, when the electroplater is going to be very much interested in the finishing of this material.

Mr. Tubbs' formal talk was really an outline of the process and its possibilities. At its conclusion further details were brought out by an extended discussion. We were all very pleased to have Mr. Tubbs with us and it is felt that a great deal of information was obtained about this important method of metal finishing.

Toronto Branch

Toronto Branch of the A. E. S. held the second meeting of the current season October 13th. Two applications for membership were received. Toronto members will cooperate with Buffalo Branch at an educational meeting in Buffalo in the near future. Mr. W. M. Fotheringham of the Buffalo Branch was present at this meeting and outlined the plans of the Buffalo committee.

Toronto Branch plans to hold a special meeting on November 17th, when a supper and an interesting speaker will be the high lights.

The members will try their skill at bowling, November 22nd, at the Boulevard Club. Valuable prizes will be given the experts. Several fine events are being planned for the winter months.

As our library is overstocked, it was decided to dispose of some of the older volumes by offering them as prizes at our Quiz sessions. The financial status of the Branch was reported to be in splendid condition.

Hamilton sent a delegation to this meeting

Announcing

ENTHONE Zinc STRIPPER

ENTHONE presents a new fast acting non-electrolytic alkaline stripper for zinc (Patent Pending)

Commercial tests for the past year prove these qualities:

1. One-thousandth of an inch of zinc stripped in less than one minute.

2. No rusting, etching or attack on steel. No matter how many times zinc is stripped there is no

attack on the base steel.

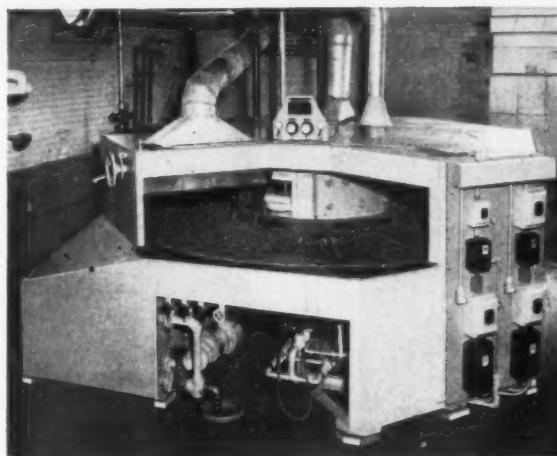
3. Simple to use and economical to operate.

Only equipment required is a heated steel tank. Operates from 200° to 215° F.

Strip defective zinc work or plating racks the modern Enthone way.

Order a trial quantity for a convincing demonstration.

THE ENTHONE CO., 446 Elm Street, New Haven 2, Conn.
Chemical Products and Electroplating Equipment



**One Man does the
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—and does it quickly
and easily

with this Roto-Table Metal Cleaning Machine

This speedy, economically operated heavy type Roto-Table Wash—Rinse—Drying Machine is a glutton for production—a time and labor saver.

Large metal parts or smaller pieces are placed in baskets on circular turn-table; (which can be operated by variable speeds) passing through the machine and returning to operator clean and dry for further treatment.

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HERE'S THE "BEGINNING OF THE END" OF YOUR FINISHING PROBLEMS

In the new Globe Tumbling Barrel Catalog, partially illustrated above, you will find the final solution to your finishing problems. It contains complete information about the nine different types of Globe Barrels in their various sizes and capacities. You will find that there is a Globe Tumbling Barrel for almost every type of finishing operation—de-burring, burnishing, polishing, painting, japanning, or drying. All of them are designed to provide finer finishing at less cost. This new catalog plus Globe's Finishing Service Department are waiting to serve you. Write today!

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1. You can process thousands of pieces at one time.
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7. You obtain superior results.



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Polishing Bench

Dryer

Tubbing

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Tanks, Coloring Rooms, Dynamos, Sawdust Boxes

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and *W. W. Wells, Jr.*, who is seldom on hand, came in with a smile.

Copies of Minutes of joint meeting of several committees' advisory to the Allocation and Conservation Division office of the Metals Controller, were distributed. These were of the 1943 meeting but were eagerly accepted by the members present.

The feature of the evening was a talk by Mr. Hicock, of the Promat Division, Poor & Co., who told us of the Promat Process of electroplating. The subject being new to the members, Mr. Hicock had no difficulty in holding their attention and interest. Charts, blackboard drawings, and samples of plated work illustrated the talk. A rousing vote of thanks was tendered Mr. Hicock.

Lancaster Branch

The Lancaster Branch of the A. E. S. will hold its regular meeting November 10, 1944, at the Charles Snyder & Son Plating Co., Harrisburg, Penna.

Harold Narcus of the Plating Processes Corp., Holyoke, Mass., will speak on "Deposition of Metals on Plastics."

Detroit Branch

The Annual Educational Session and Dinner Dance of the Detroit Branch of the A. E. S. will be held at the Hotel Statler, Detroit, Mich., on Saturday, December 9, 1944.

The following speakers will speak at the Educational Session at which Walter Pinner will preside as chairman:

Dr. Walter R. Meyer, Technical Director of the Enthone Company, New Haven, Conn., will speak on "Chemical Treatments for Copper and Aluminum"; Dr. Charles Faust of the Battelle Memorial Institute will speak on "Practical Aspects of Electroplating"; Dr. Ralph L. Lee, Public Relations, General Motors Corp., will deliver his famous address, "Human Engineering."

In the evening, Ray Garrell and his artists will furnish dinner music and later put on a high grade floor show, followed by dancing.

Indianapolis Branch

The Indianapolis Branch of the American Electroplaters' Society held its monthly meeting October 4, 1944, at the Hotel Riley. A chicken dinner was served at 6:30 P. M. The

business meeting was called to order by the president, Arthur L. Chesterfield, and was attended by 57 members and guests.

The secretary's and treasurer's reports were read and approved as read. The stag party committee reported a stag party will be held November 4 at the Liberal View League, located on the south side of Indianapolis.

The Branch elected 8 new members, 3 active and 5 associates.

Mr. W. W. Cochran, the librarian of the Indianapolis Branch, introduced the speaker of the evening, Mr. G. A. Lux, of Oakite Products, Inc. Mr. Lux used as his subject "Polishing and Buffing." He briefly reviewed the work he had done at the Bureau of Standards and explained how he had become interested in polishing and buffing operations. The speaker described the difference between polishing and buffing and elaborated on each subject. He described the different wheels now in use, how they are made, what they are made of, also their uses.

A number of different wheels were passed among the members so that each individual might have a knowledge of the wheels described. Upon completion of his talk he answered a number of questions asked by individuals of the group present. The group gave Mr. Lux a hearty applause upon completion of his excellent talk.

Los Angeles Branch

With cleanliness a paramount issue in plating shops at present in order to preserve equipment and materials made scarce by the demands of the war, two timely talks on these subjects were presented by members of the Society at the October 9th meeting of Los Angeles Branch, A. E. S.

In the first talk, Sid Hill, head of Hill Electric Co., Los Angeles, discussed "Electrical Maintenance in the Plating Shop"; and in the second, F. Carl Hirdler, Jr., chemist of Turco Products, Inc., presented "An Outline of Modern Cleaning Methods."

In his discussion of electrical maintenance, Mr. Hill emphasized the need by all progressive plating shop operators of a planned program of maintenance of all equipment, particularly electrical units which quickly lose efficiency if grime and dust are permitted to accumulate on vital parts.

In urging a regulated program of equipment inspection, Mr. Hill pointed out that no machine or equipment is absolutely vapor proof or impervious to the infiltration of corrosive gases given off in plating departments. Only regular inspection will make it possible to keep the machinery in efficient operation, he stressed.

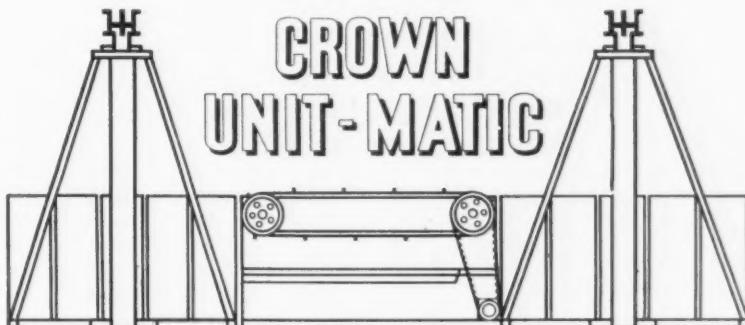
Concerning plating shop illumination, Mr. Hill pointed out that a tendency to allow accumulated dust and grime to remain on lighting fixtures and reflectors is tantamount to deliberate impairment of the foot-candle power for which the lamps were originally designed.

Mr. Hirdler discussed individually five types of cleaning, which he listed as solvent wiping, vapor degreasing, steam cleaning, emulsion cleaning, and alkaline cleaning systems.

He outlined also the purposes of hot tank

Crown

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FULLY AUTOMATIC PARTIALLY AUTOMATIC EQUIPMENT

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cleaners and defined the respective uses of heavy-duty and light-duty cleaners of this type.

Mr. Hirdler said that 95% of all cleaning troubles usually are due to two major causes —rinse water deficiency or solution control. Rinse water should be kept clean, he urged, and any attempt to cut expenses by skimping on the volume of hot water in rinsing operations is foolhardy and expensive in the long run.

Concerning solution control, Mr. Hirdler cautioned that pH is only a yardstick for determining the quality of alkalinity of a solution and not the amount of alkalinity.

National Chemical Show and Conference, Chicago, Nov. 15-19

Reflecting the importance of industrial chemistry in the war effort and revealing new processes, products and ideas that will enhance peacetime progress, the third biennial National Chemical Exposition and National Industrial Chemical Conference will be held November 15 through 19 at the Coliseum in Chicago.

Sponsored by the Chicago Section of the American Chemical Society, the show and conference will be of value to a vast cross-section of interests, including chemists, engineers, bankers, educators, manufacturers whose process in some way involves chemistry, and all those holding technical and management positions.

Commercial exhibits will occupy every foot of floor space available for that purpose in the huge Coliseum and its Annex. The conference will be held on the second floor of the Annex and may be entered from the Coliseum floor. It will be devoted to the field of applied chemistry.

An innovation which will mark the opening of the 1944 exposition and conference, will be a joint luncheon with members of the Chicago Association of Commerce and the Chicago Section of the American Chemical Society taking part at the Palmer House on November 15. A discussion of "New Research Developments in Industry" will be given by Roy C. Newton, Swift & Company; J. K. Roberts, Standard Oil Company (Ind.); and Ernest H. Volwiler, Abbott Laboratories.

American Society for Testing Materials

Heavy demands for the 1942 Book of A.S.T.M. Standards and its Supplements occasioned by the war production efforts have necessitated advancing by a full year publication of the next book. Normally this would come out in November-December 1945 on the triennial basis, but the Book will be issued in December, 1944.

Very widely used by American industry and many branches of state and federal governments, this book providing authoritative specifications and tests for a wide range of engineering materials, will cover some 6,000 pages in three parts: I, Metals; II, Non-metallic Materials—Constructional (cement, lime, concrete, paint, etc.); III, Non-metallic Materials—General (petroleum, textiles, plastics, coal, rubber, etc.).

Manufacturers' Literature

Degreasing with Chlorinated Solvents

A booklet of standard practices for degreasing metals or other non-porous materials with chlorinated solvents has been released by *E. I. du Pont de Nemours & Co.*, Dept. MF, Wilmington, Del.

Distributed free upon request, it has been prepared by the Solvents Division of the Electrochemicals Department of the Du Pont Company in consultation with *G. S. Blakeslee & Company*, Chicago, and *Detrex Corporation*, Detroit, manufacturers of degreasing equipment.

A number of typical degreasing machines are illustrated in the 10-page booklet.

Vapor degreasing is used for cleaning metal parts of all kinds prior to inspection or assembly, or in preparation for subsequent processing or finishing operations such as rustproofing, painting, electroplating, anodizing and galvanizing. Glass and plastics are also frequently cleaned by this method. The essential part of the process is suspension of the material in the vapors of trichlorethylene, or sometimes perchlorethylene, so that the pure, condensed, liquid solvent rinses the parts free of grease and oil.

The booklet outlines the fundamentals of machine design, installation and operation which must be considered to insure safety and efficiency.

Flat Spray Nozzles

Chain Belt Company, Dept. MF, 1644 W. Bruce St., Milwaukee, Wisc., has just produced a new folder descriptive of Rex Flat Spray Nozzles. These nozzles are in service in practically all industries where water is used in cleaning, cooling and washing operations. They are made in a variety of sizes and from a variety of materials. The folder besides illustrating and describing the nozzle uses gives tabular information concerning their discharge in gallons per minute; their dimensions; a list of materials, sizes and prices.

Koroseal

A new catalog section on its *Koroseal Tape RX* and *Korolac RX*, a solution of *Koroseal*, easy-to-apply protective coatings for plating racks has just been issued by *The B. F. Goodrich Company*, Dept. MF, Akron, Ohio, and is now available upon request. The products were specially designed for plating rack service, with application by the user and can be applied either separately or together.

Characteristics and properties of *Koroseal* and *Korolac* which make them valuable for this service are outlined in the catalog section, together with well illustrated instructions on how they should be applied.

Grinding Facts

To acquaint grinding wheel users with the newly announced standard markings for identifying grinding wheels and other

bonded abrasives, *The Carborundum Company* has prepared "Grinding Facts" a 136 page reference book on grinding—including a complete explanation of the new marking symbols; a comprehensive schedule of grading recommendations for general, toolroom, diamond wheel, and thread grinding; a description of each common type of grinding; safety rules; and a table of useful speeds.

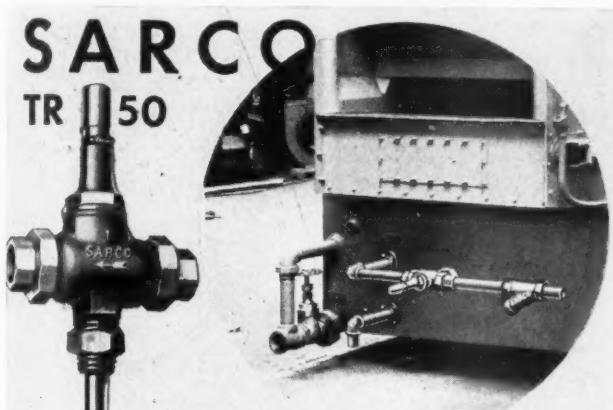
For a free copy of "Grinding Facts" write on your business or company letterhead to *The Carborundum Company*, Dept. MF, Niagara Falls, N. Y.

Allowable Pressure Books

A 20-page booklet has just been issued by *Tube Turns, Inc.*, Dept. MF, of Louisville, Ky., giving allowable working pressures for welding fittings in five classes of piping—power, oil, district heating, gas and air, and refrigeration. Fourteen convenient tables list allowable pressures at the indicated temperatures for any size and weight *Tube-Turn* fitting. All tabulations are made in accordance with the Code for Pressure Piping A.S.A. B31.1—1942.

Protective Skin Creams

A new catalog section on its *Clad* protective skin creams, for use either for wet or dry work, has just been issued by *The B. F. Goodrich Company*, Dept. MF, Akron, Ohio, and is now available upon request. The catalog section describes conditions under which either type should be used, describes its benefits and ease of removal with water, or soap and water.



COMPACT TEMPERATURE CONTROL

Where piping must be simple, or space is at a premium, you can use this rigid stem regulator at a substantial saving in first cost.

Recommended for storage water heaters or process tanks under constant load.

Sizes $\frac{1}{2}$ " to 2" for temperatures to 250°F , pressures to 125 lbs. Catalog No. 600.

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174



News from California By FRED A. HERR

Hughes Aircraft Co. has installed additional metal finishing equipment in its Armament Division plant in Hollywood for use on booster housings of airplanes.

The new units include a chromatizing setup of three 100 gallon tanks and three tanks of smaller capacity for hot etching prior to spot-welding on aluminum.

Charles Ferrelli, formerly with Vultee Aircraft Corp., Downey, Calif., is general manager of the Hughes plants, with A. L. Sulzinger serving as head of the processing department in Hollywood.

A. L. Speser, partner with Spencer Wright in the operation of the S. & W. Plating Co., 1356 West 25th St., Los Angeles, has been appointed West Coast representative for the R. O. Hull and Co., Cleveland, O., which was recently organized by R. O. Hull, chief research chemist of the Du Pont Co. in Cleveland and originator of the Hull cell, to deal in plating salts and addition agents.

Mr. Speser will represent the company in California, Oregon, Washington, Arizona and Nevada and will also continue his activity with the S. & W. Plating Co.

F. Carl Hirdler, research chemist and process engineer for Turco Products, Inc.,

Los Angeles, recently returned from a trip of several months during which he visited the plating divisions of major defense plants and Government depots in the Southwest, Middle-West and Pacific Coast to assist in solving tricky chemical problems in plating with which the managements were confronted.

Plastics will not reduce the amount of metals used in the post-war world but will increase the volume, Dr. Allan Bates, Westinghouse Co. research scientist, stated in a talk before a joint session of the American Society of Mechanical Engineers and American Society for Metals at Los Angeles recently.

"Both plastics and metals have inherent advantages and disadvantages that bar any complete replacement of one by the other," Mr. Bates said. "Actually more metals will be used in the future because their partnership with plastics will make possible many new products."

Non-conductive metals and materials, such as plastics, will represent one of the major developments to effect the plating industry after the war, discussion at the meeting brought forth.

A visitor at the October 9 meeting of Los Angeles Branch, A. E. S., was James ApRoberts, oiler technician, U. S. Navy, now stationed at the Naval Base in Long Beach, Calif. Prior to his enlistment in the

Navy, Mr. ApRoberts had been active for the past several years in research and chemical engineering capacities with Lockheed Aircraft Corp. and Tripplett and Barton Technical Laboratories, Burbank, Calif., and with Turco Products Co. and the U. S. Navy Inspection Service, Los Angeles.

Notice of intention of engaging in business under the name of Abbott Metal & Plastic Novelty Co. has been filed by Ray Kronsberg and A. Abbott Schy.

Charles C. Wirth, former plating foreman for Aircraft Associates Corp., Burbank, Calif., has transferred to Menasco Mfg. Co., also of Burbank, as assistant foreman of plating. The firm produces airplane motors, struts and other plane parts. It operates a chromium and zinc installation consisting of six zinc tanks averaging 300 gallons per tank and six chromium tanks ranking in capacity from 300 to 600 gallons.

K. F. Forsyth of the Emsco Derrick & Equipment Co., Los Angeles, has been named Western member of the Office of Price Administration's industry advisory committee on hot dip galvanizing. The committee is composed of 12 representatives of firms producing hot-dip galvanizing products.

TYGON TEMPRO-TEC STOP-OFF

APPLY Tygon Tempro-tec, clear or in colors, by spray, brush, or dip. Air dry 6-8 minutes. Resists all plating solutions, including hard chrome. Peels easily free after plating cycle. Will not take a plate. Can be re-dissolved and used again. Price \$5.00 to \$5.50 per gallon for the clear, depending on quantity ordered.

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MATERIALS AND EQUIPMENT

- Resists all plating solutions
- High dielectric strength
- Strips easily free
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"I won't be in Today!"

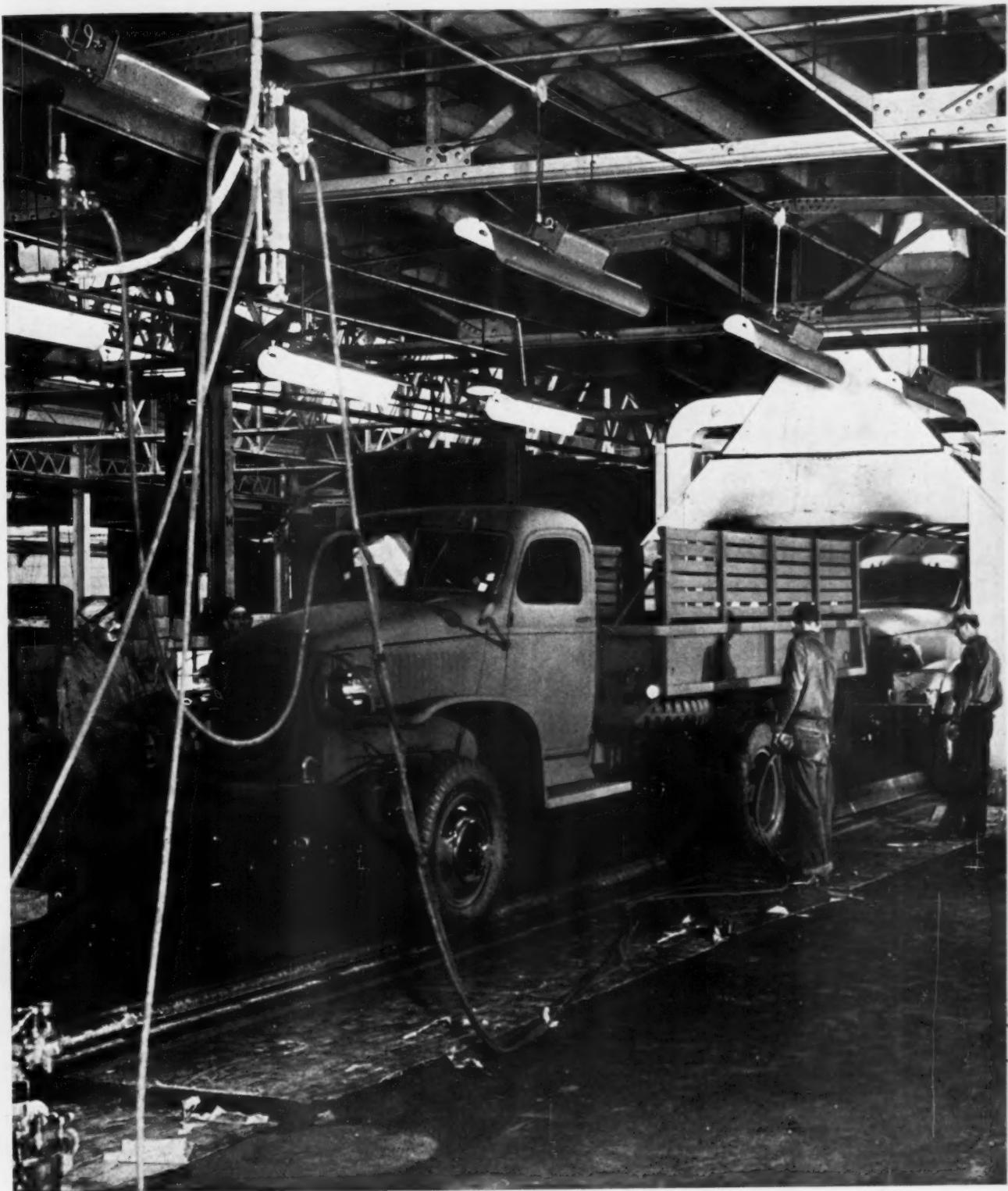
How many of these calls are due to skin irritations in your plant? Tarbonis can stop them! Not merely a protective—effective in clearing up the more difficult conditions. Clean and neat and can be applied on the job—promptly reduces itching and irritation. Many outstanding plants whose names are on every tongue in America appreciate the quick and effective action of Tarbonis. Write us for sample, dispensing manual and booklet for employee.

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METAL FINISHING, November, 1944

NOVEMBER. 1944

SECTION OF METAL FINISHING





Consider a business machine, for example—usually thought of as utilitarian, rather than decorative. Metalite it and it becomes not merely a machine, but a piece of office furniture, beautiful and durable. A Metalite finish is *alive*. Ordinary color finishes may do the job, but Metalite adds that extra *sales appeal* that really helps sell a product.

ZAPON METALITES represent a group of metallescent pigmented coatings offering unlimited possibilities for stepping up the *sales appeal* of new designs and products. Metalites provide you with a wide range of colors—colors that are *alive in themselves*. They are available in varnish and lacquer enamel bases.

ZAPON DURANITES also may be had in Metalite. Duranite's time-proven qualities—short bake, toughness, corrosion resistance—gain strikingly in appearance when you Metalite them.

ZAPON HAMMERED FINISH provides striking effects that lend themselves readily to distinctive designs. Zapon Hammered Metalite Finish may also be used as a trim on any Metalite finished product to get unique results in enhanced appearance that means extra eye-catching appeal.

EXAMINE THESE THREE ZAPON FINISHES YOURSELF!

Drop us a line on your business letterhead and we'll send you finished panels showing three of these product improvers—Duranite in Color, Duranite Color Metalite and Duranite Hammered Finish. The panels will help you visualize how these finishes can give your products the 'life' that means added sales. Many excellent formulations are available now.



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ATLAS POWDER COMPANY

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INDUSTRIAL PRODUCT FINISHES... Doing Tomorrow's Job Today!

Section of

METAL FINISHING

Founded January, 1903
as Metal Industry

Publication Office
11 West 42nd St.
New York 18, N. Y.

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Cover Photograph

Spraying Army trucks at Chevrolet Plant, St. Louis, Mo. Photograph courtesy Binks Manufacturing Company, Chicago, Ill.

ORGANIC FINISHING

SECTION OF METAL FINISHING

NOVEMBER, 1944

Gloss in Post-War Finishing

Before the war there was relatively little interest in the subject of gloss of organic finishes. Understanding of this important characteristic of surface coatings was not general. Few glossmeters were in use and visual determination of gloss and such broad classifications as matte, semi-gloss and full gloss were considered sufficient.

The necessity for meeting rather close gloss specifications on finishes for war items has, however, changed this situation. Glossmeters are found in many if not most finishing departments and there has come about a general knowledge and appreciation of gloss, factors affecting it and the relationship of gloss to other characteristics of organic finishes. Specular reflection, diffuse reflection, sheen, sharpness of image gloss and other terms not in use a few years ago are now commonly heard in finishing departments.

We believe that this development in the understanding of gloss and the more widespread use of glossmeters will help considerably in post-war finishing. It will be another scientific tool for the better control of peacetime finishing. Manufacturers and users of finishing materials will have exact quantitative values with which to work and not vague qualitative terms as in the past. Most important, it will aid in describing and specifying finish appearance.

In connection with this last point, finish appearance depends on a number of factors including gloss and it is not always easy to judge by eye the causes for differences. For example, a manufacturer working on aluminum finishes for a post-war product found that what appeared to be a duller, flatter aluminum finish was obtained with a lacquer base vehicle than with a varnish vehicle. The glossmeter, however, showed that the gloss of the aluminum lacquer was actually higher than that of the aluminum varnish. The problem was found to be in the difference in the leafing of the aluminum powder in the two vehicles. An adjustment was made in the lacquer vehicle to obtain improved leafing and the dullness, thought at first to be due to lower gloss, disappeared.

Step by step, as pointed out in our various editorials and as shown by discussions appearing in ORGANIC FINISHING, organic finishing is taking a more important position among manufacturing processes based on scientific tools and methods. The experience and knowledge of gloss gained in this war have helped finishing to this position.

IT'S NEW...
IT'S DIFFERENT...
IT'S "EGYPTIAN"!

METL-PRIME

Here is the new prime coating for metal, specially made to meet war and post-war finish requirements.

Sprays on or Dips.

Dries dust-free in 5 minutes.

Dries to handle in 10 minutes.

Dries to practical hardness in 20-30 minutes.

Gives fine hard satin-smooth finish.

METL-PRIME saves time. No sanding needed before lacquer or other top coat. METL-PRIME saves trouble. Won't lift or bleed through even a white enamel finish. Write for any special finish information you may need.

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ROCKEFELLER CENTER, NEW YORK 20, N.Y.



EGYPTIAN

SPECIALIZED PRODUCTION FINISHES

NEWS FROM WASHINGTON—

By George W. Grupp

METAL FINISHING's Washington Correspondent

Smiley Resigns as WPB Consultant

John B. Smiley, one-time president and chairman of the board of directors of Remington Arms Company resigned as consultant to the Alcohol and Solvent Section of the WPB's Chemicals Bureau on October 6, 1944.

Acetic Acid and Acetone Expansion in Sweden

Chemically pure and technically pure acetic acid will be produced in this new plant from the waste liquors of the distillation plant. The new plant will have an annual capacity of about 1000 metric tons of acetic acid. Facilities are now under construction for the converting of acetic acid into acetone and solvents for the lacquer and varnish industries.

Acrylic Resin now Under Schedule 17 of Order M-300

All grades of acrylic monomer and acrylic resin were brought under the control of Schedule 17 to Order M-300 on September 20, 1944.

Adipic Acid now Under M-300 Control

The control of adipic acid, which is used in producing plasticizers and insulating resins, was transferred to Schedule 55 of Order M-300 on October 4, 1944. On the same day the adipic acid Order M-304 was revoked.

Chemical Order Amended in Anticipation of Reconversion

Order M-300 was amended on October 2, 1944 to facilitate the handling of allocated materials during the reconversion period. The amended order makes it possible to continue control over that part of chemical distribution which is essential for the war effort. Chemical Bureau officials stated that the amended order applies only where the supply is adequate to permit the lifting of controls on allocated materials for specified civilian end uses. The amendment is not intended to be used as a substitute for revocation of an allocation order when the material is no longer in "over-all short supply."

Ecuador is a Market for Synthetic Resin

The Department of Commerce reports that Condor Industria Quimica of Quito, Ecuador, manufacturer of paints and lacquers, is Ecuador's only regular user of synthetic resins. Condor uses alkyd resins in its manufacture of heat and weather protective coatings for automotive and military equipment. It also produces anti-corrosive paints for boats and sanitary articles.

Gum Rosin Prices

The Office of Price Administration announced on September 19, 1944 permanent maximum prices for gum rosin at levels based on the average prices prevailing during June and July of this year for sales on the Savannah, Georgia Cotton and Naval Stores Exchange. The Exchange prices, per 100 pounds net in drums, listed in the regulation for the 13 different grades are as follows: X-\$6.31; WW-\$6.31; WG-\$6.04; N-\$5.79; M-\$5.63; K-\$5.61; I-\$5.57; H-\$5.57; G-\$5.55; F-\$5.51; E-\$5.41; D-\$4.88; and B-\$4.81.

Gum Rosin Price Increased 24 Cents A Hundred Pounds

Amendment No. 1 to Maximum Price Regulation No. 561 was issued on October 11, 1944 to permit a 24 cents per 100 pounds increase of the present ceiling prices for gum rosin.

Import Restrictions Eased

General Imports Order M-63 as amended September 25, 1944 has removed from Government import control bleached and unbleached shellac.

Lac Crop Doubles in 1944

From a report of the Indian Lac Cess Committee of India it was learned that the 1944 Baisaki lac crop would be about 770,500 maunds (1 maund equals 82.28 pounds). The 1943 yield was only one half of the current year's yield.

Linseed Oil Paint Shortage in U.K. Continues

The Department of Commerce reports that there is still a shortage of linseed oil paints in the United Kingdom in spite of the fact that such paints are no longer restricted.

Marine Paint Automatic Preference Ratings Urged After Defeat of Germany

paints required for the after the defeat of Germany.

The Marine Paint Industry Advisory Committee at its October, 1944 meeting told WPB officials that automatic preference ratings must be maintained for the production of maintenance of ocean-going vessels

Naval Stores Industry May be Developed in Bahamas

The Bahama Islands Government is planning to develop a naval stores industry on the islands of Abaco, Andros, and Grand Bahama. This industry will be developed on Government leased pine timber lands.

Turpentine Substitute Used in Brazil

Because of the high cost of turpentine the Brazilians are using a substitute which is made from a petroleum base mixed with a small percentage of gum spirits of turpentine.

Reconversion Will Be Up To Private Industry

Edward R. Gay, assistant vice-chairman for Civilian Requirements of the War Production Board, on October 19, 1944 declared that "the job of reconversion, when it comes, will be put squarely up to industry with an absolute minimum of interference from Washington." And he continued by stating that he is "confident that industry will accept the challenge gladly and do a better job than any of us in Washington could plan."

Many WPB Orders Revoked or Relaxed

During the month of September 1944 the War Production Board revoked such orders as Cellulose Ester Flakes Order M-326; Cellulose Ester Sheets, Rods and Tubes Order M-326a; Cellulose Acetate and Cellulose Acetate Butyrate Molding Powder Order M-326b; Copper Chemicals Order M-227; Kitchen Utensils Order L-30c; Nonferrous Metals Order L-26 8; Pens and Pencils Orders L-227 and L-227a; Pyrethrums Order M-197; Rotenone Order M-133; Sodium Cyanide Order M-366; Sodium Metasilicate Order M-355; and Vinyl Polymers Order M-10. Among the WPB orders which relaxed some of their restrictions are Aluminum Order L-188; Aluminum Pressure Canners Direction 1 to L-30d; Aromatic Solvents Order M-150; Bicycles Order L-52; Builders' Finishing Hardware Order Schedule I of L-236; Can Production Order Schedule IV of M-81; Caskets and Vaults Order L-64; Cooking Equipment Order L-182; Copper Order M-9c; Flashlights Order L-71; Metal Furniture Order L-13; Metal Storm Windows Order L-77; Silver Order M-199; and Zinc Order M-11b.

WHERE LIFE AND VICTORY DEPEND ON SPEED



U. S. Navy Photograph

"GRUMMAN HELLCATS" Use **SPEED-ALAKA***

Again ALAKA Laboratories have come through with a perfect score! Grumman wanted to obtain a finish not only conforming with the requirements of specification M-485-Ct for Non-Specular Lacquer, but with a new quality added . . . smoothness for Speed

The problem was put to ALAKA! ALAKA chemists got busy . . . lights burned a little later in ALAKA laboratories . . . and "SPEED-ALAKA" was born. Air-dried in less than 5 minutes it adds speed to production as well as an increase of speed in flight. And it of course requires no buffing.

This material may be made glossy to meet specification AN-TT-L-51.

*Pat. Pending 546756

†Superseding Specification AN-L-21.

Custom Tailored Finishes
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Write us on your letterhead and we will send you a copy of our new, complete, up to the minute catalogue of U. S. Government Specification Finishes.

WHATEVER
YOUR
FINISHING
PROBLEM

TAKE IT TO
ALAKA

Teaching Finishes and Finishing

By F. W. SCHWARTZ

*Professor of Analytical Chemistry
Rensselaer Polytechnic Institute
Troy, N. Y.*

Many engineers must learn about finishes and finishing by experience alone during their professional careers. At Rensselaer Polytechnic Institute, engineering students receive both theoretical and practical training in this field in order that they may more intelligently handle the finishing problems with which most of them will come in contact. This article describes the course.—Ed.

AT Rensselaer Polytechnic Institute in Troy, New York, a course is given which is rather unique in educational institutions. It is one in which both the theory and practice are covered. Only seniors and postgraduate students take the course. The theoretical chemistry that these men have studied, having been but slightly used up to now in their scientific careers, needs to be presented anew for the proper understanding of this course. This type of instruction sets the work apart from trade school teaching.

Pigments

The subject matter of the course is naturally divided into a number of parts. The first deals with pigments and inert materials. Where there is a naturally occurring material, its composition is discussed as well as the usual methods of purifying, grinding and sizing. The suitability of various pigments for specific purposes and any poor qualities they may confer on the finished paint film are explained. Specifications for the substances examined and the effect of the variations from the ASTM and U. S. Navy Specifications are thoroughly discussed.

The resistance of these substances to outside influences, such as smoke, chemical fumes, moisture, weathering, sunlight and abrasion is studied. Specific conditions, such as acid or alkaline exposure, are analyzed and probable solutions and methods of dealing with them are devised. This

type of instruction is continued with synthetic pigments and lake pigments.

The use of powdered metals and their vehicles is included in the theory covered, also the use of such materials as tars, asphalts and pitches. The suitability of paints of this type and their limitations are explained.

Vehicles

After the students have finished with the pigment components of paint, vehicles, thinners and dryers come in for full discussion. The introduction to vegetable oils starts with the occurrence of the oil bearing seeds, then takes in the effect of climate on the quality of the oil produced and ends with the consideration of characteristics of pure and adulterated oils. A thorough understanding of the chemistry involved and the significance of the usual analytical constants as they are determined by the chemist is necessary. It is at this point that the necessary chemical theory is presented. The action of thinners and diluents, as well as dryers, naturally follows the discussion of the oils.

Since, from time to time, it is necessary to apply coatings to hot surfaces, paints suitable for this purpose are described. Temperature indicating paints, that is, those which change color with a change in temperature, are included.

The study of the completed paint is next taken up. Packaged paints of standard and sub-standard grades are examined, many of which are analyzed in our laboratory by other groups of students. Some of the compositions are taken from the producer's information on the container and the quality of the paint is thus determined. For example, the various constituents found in a particular paint are discussed by pointing out the specific color produced,

the necessary ingredients and the unnecessary ones which only make the paint cheaper or are used to alter the consistency. In some cases, exposure tests are made.

With a background of this type, students are well prepared to study paint and painting defects. This is done by actual inspection not by pictures or descriptions. For some of the students it is necessary that painting costs be known and, to round out their work, some methods of estimating paint and painting costs are presented. This phase of the work is always of particular interest to the students of architecture.

Varnishes

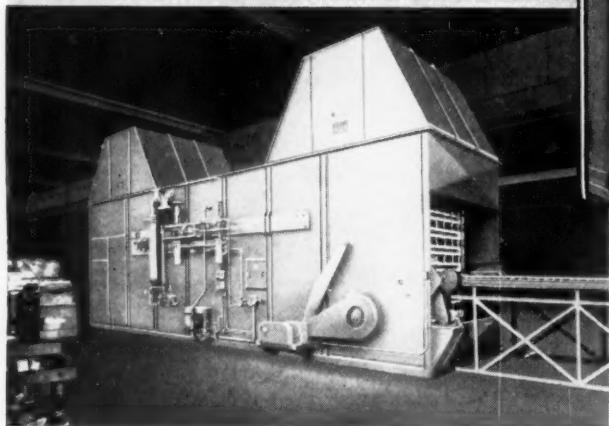
Oil and spirit varnishes are next discussed and a brief description of the principal natural and synthetic resin and oil enamels is incorporated with this subject. Varnish making is only briefly mentioned, as this is an art and many of the practices are not too well known. The merits and limitations of calcimines and distemper paints and the advantages and disadvantages of employing such paints from an economic standpoint are considered.

Lacquers

The theory of lacquer and lacquer enamels calls for another session in organic chemistry before serious work can be done on this subject. Little is said concerning the manufacture of the various solvents, thinners and plasticizers, for these men will not manufacture but, rather, purchase such materials. Various methods of application are taken up with particular attention being paid to the character of the volatile solvents. Occupational hazards and approved methods of prevention are described.

Under-water paints have an interest for some of the students, so com-

This DETREX DEGREASER for Armament Work



Above is a close-up view of the unloading end of the large automatic Detrex Degreaser illustrated at left. Sheets of metal after cleaning are removed automatically onto a roller type conveyor.

IS DESIGNED TO HANDLE PEACETIME WORK

Without One Construction Change!

In past months, Detrex engineers have designed many machines intended primarily for the cleaning of metal products required for armament purposes. But, in innumerable instances, their engineering work has gone further than the immediate purpose of the equipment. To help the customer reconvert to peacetime production quickly and at a minimum cost, equal consideration has been given to the type of products which will be produced after the war.

The Detrex Vapor-Spray-Vapor Degreaser shown above is now cleaning sheet steel. Without a single change, it will be used later for cleaning drum heads as well as sheets. In the case of other machines, minor changes will make possible almost immediate use of Detrex equipment in reconversion programs.

If your metal cleaning problems are those of today OR TOMORROW, call in a Detrex engineer. He can offer the advice and cooperation you're looking for.

DETREX CORPORATION

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DETROIT 27, MICHIGAN



BACK THE ATTACK
BUY MORE WAR BONDS

position of various barnacle and marine growth repelling paints is discussed, especially with regard to their efficiency.

The newer synthetic oils receive their share of attention at various times during the course and it is necessary to paint metals with some of the mixtures under consideration. This then introduces the preparation of surfaces, both metallic and non-metallic, as well as paint removal from various types of surfaces. Methods of paint removal, with some cost data, naturally are taken up. Sand and shot blasting, as flame cleaning and scraping and removal by liquids for work on smaller surfaces are included.

Even such minor items as putty and fillers are not neglected and with their consideration, stains and staining are then briefly discussed. After this, the matter of varnishing or lacquering is again revived and finally the subject matter gravitates to the refinishing of antique furniture. This always seems to interest most of the men taking the course. First, the method of how the old finish can be removed; second, how the color can be restored; and third, the final finishing with the sanding, pumice and polishing. It is impossible to consider the cost of work of this nature in the time allowed for the course.

A rather interesting problem from the construction standpoint is the various difficulties which arise from termites. Therefore, a large portion of time is devoted to termite proofing wood. This covers a discussion of the methods employed and the efficiency under various conditions.

Further work is done by many of the students in analyzing some of the commercial products on the market. Research is conducted with both pigments and vehicles. New ultra-violet resistant pigments have already been developed and some work has been done on the improvement of soy bean oil with reference to its drying properties.

On the completion of this course, students are able to specify a paint for a specific purpose and also have an idea of the probable cost of the work. They should be able to diagnose paint failures and suggest measures for correcting the trouble.

COLOR FACTS

By STANLEY T. DINGMAN

Linden, N. J.

In the finishing of metal, wood and plastic products intended for consumer use, not only the quality of the finish but also its color is of considerable importance in determining consumer acceptance. Regardless of the inherent value, quality or utility of the product itself, it will not command as much attention or as many sales as it should if the color does not conform to certain definite patterns of consumer preference. The prudent manufacturer and his product engineers find it valuable to study these color preferences and to apply the fundamental principles which years of study have revealed.

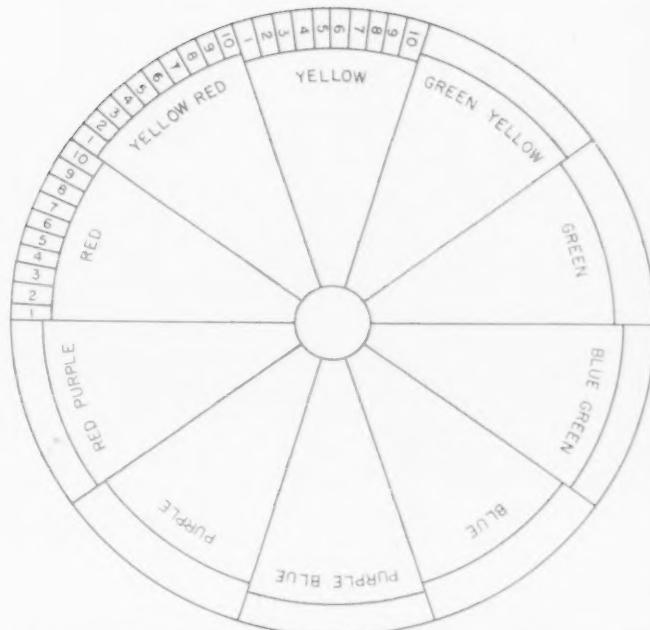
Color Preferences

As most everyone realizes, adults generally prefer red and blue, with red having the edge in popularity. Following these two color preferences come green and then yellow. If, however, the manufacturer is concerned with the infants' and childrens' market, he will do well to forget adult preferences, because young children have a marked fondness for yellow, with red and white as second and third choices. This fondness for yellow tends to be replaced with a liking for green as the child grows up. At maturity, women prefer red and men prefer blue. Purple also begins to find considerable favor.

There are, of course, several other factors which influence color preference and thus, also, the sale of merchandise. People of Nordic ancestry will probably prefer cool greens and blues, while those of Latin forebears are likely to give their preference to reds and maroons. Economic status may also build up certain differences, with the choice of those with fairly good incomes giving preference to conservative colors and those of lesser incomes preferring bold, exciting colors.

Color preferences also differ with the type of product and the use to which it will be put. Blue rugs, for instance, are preferred by the housewife with more than twice the frequency than red, but when she comes to buy blankets she will be more likely to choose peach and dusty rose, respectively. For kitchen towels, however, she will give her preference to red. This preference will also go to other kitchen items. White porcelain enamel with red trim will be preferred slightly to ivory with green trim. While with black trim will come next. White bread boxes, canister sets, disposal cans and waste baskets with red trim will have almost twice the popularity of those with blue trim. Those with green trim will come third.

While it is easy to make certain generalizations about the appeal value of the major colors, these generalizations are unsuited to the actual selection of colored finishes for all types of consumer products because of the wide variation in individual conceptions of what color



Munsell Color Circle. The complete circle contains 100 hues.

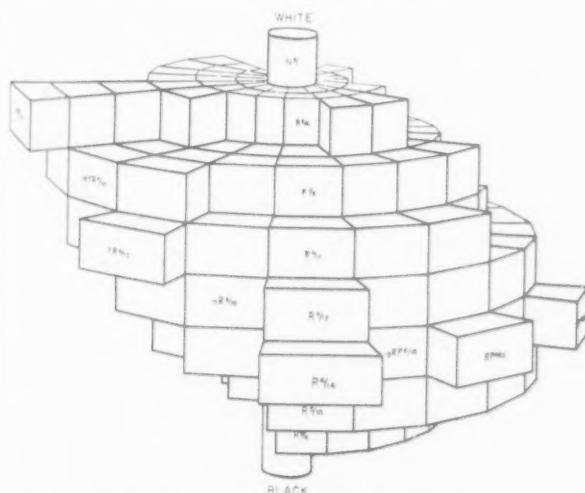
names signify. Suppose, for instance, that the sales department of a kitchenware manufacturer has decided to capitalize upon the preference for red trim on kitchen utensils and so notifies the finishing department. The color may satisfy both the finishing and sales departments but the products may not move off the shelves of retail stores as rapidly as some competitive items. Why? Because the name red may mean something entirely different to the housewife than to the man who mixed the color for the finish. This is not as much an overstatement as it may seem to be when one realizes that the Munsell color circle recognizes ten different hues of red which are bordered on either side by the red purples and yellow reds. Each one of these hues may vary both as to value, that is, its apparent lightness as compared with white, grays or black, and also as to chroma, which refers to purity, saturation or apparent degree of departure from a neutral gray.

Color Terms

There are, of course, popular names for many of the several hundred possible colors of varying hue, chroma and value. Women (who, incidentally, have a much greater color sensitivity than men) may scoff at the sales manager's conception of red and label it as coral, cerise, vermillion, crimson or something else that does not fit into their ideas of what the color for kitchen utensils should be. As a matter of fact, the names used to designate certain identical colors may be quite dissimilar depending upon the experience of the individual. For instance, the color ivory is sometimes referred to as Massicot yellow, polar bear or weak greenish yellow. Strangely enough, the name ivory is also applied to still another color that is variously known as cream, leghorn or weak yellow.

As the variations in color conception can and do lead to confusion, serious attempts have been made to set up certain standards by which the manufacturer can guide himself in the preparation of colored articles. Of course, before specifications are formulated, there must be some agreement as to color terminology and definition. Unfortunately, there is no universally adopted system that relates a specific name to specific color. And, also, there is no positive agreement as to actual number of different color variations. There have been several color systems set up in attempts to put some order into the confusion that exists in color terminology but none of these has as yet been universally accepted, probably because each one may have some shortcomings and thus not meet the requirements of all industries which are concerned with color.

Underlying the difficulty in color measurement and color terminology is the fact that in the visible spectrum there are no positive or sharply defined differences in adjacent color tones. This is because color differentiation is based upon the frequency with which light rays strike the eye and the visible spectrum covers a range of



Munsell Color Solid. One of the several ways in which the Munsell system may be illustrated. Light colors appear at a level near white. Dark colors appear at a level near black. Intense hues extend farther from the gray scale than pale colors.

wave lengths from about 3800 to 8000 Angstrom units, the shorter, or violet, waves striking the eye with much greater frequency than the longer, or red, waves. And, quick as the human eye may be, it just is not capable of discriminating between colors which approximate each other in wave frequencies around 800 trillions per second. Therefore, the best that can be done is to divide the visible spectrum into arbitrary sections of broad enough range for the eye to discriminate between them.

Color Systems

This, in effect, is what the color systems so far devised have attempted to do. Once these arbitrary sections have been set up, certain designations are given to each for purposes of identification and specification. Of all the color systems so far set up, the Munsell and Ostwald are, perhaps, the best known in the United States. But the actual lack of universal acceptance of any one system can be seen from the fact that in its commercial standards, the National Bureau of Standards refers each of its standards for color to several different systems. The preference, if any, in this country seems to be for the Munsell system which is referred to in color reference samples issued by the National Bureau of Standards.

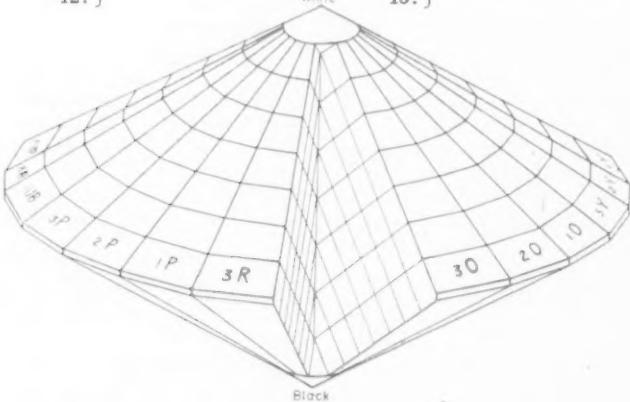
Munsell System

The Munsell system endeavors to provide a three-dimensional conception of color. To do this it employs a solid based on a sphere. At one end, or pole, of the axis is white and at the other end is black. The axis itself ranges through the neutral grays from black to white. Yellow and other light hues are placed near the white apex and dark colors like purple are near the black pole. Colors extend laterally from the axis and those of strong saturation, red for example, extend further from the axis than do weaker colors like blue-green. Each individual color is identified by three factors, namely, hue, value and chroma. Letters indicate the hue and numbers indicate both the value and the chroma. Letters identifying the hue are the initial letters of the color. Thus, R would indicate a red and YR a yellow-red. Numbers from 1 to 9, indicating value, range upward from black to white and those indicating chroma range outward from the axis, or neutral gray. Hues of strong chroma, or brilliance, may have numbers as high as 14 or more. A designation of a color as R 5/3 would indicate a soft, grayish red that was midway between black and white in value and only three steps away from gray in chroma.

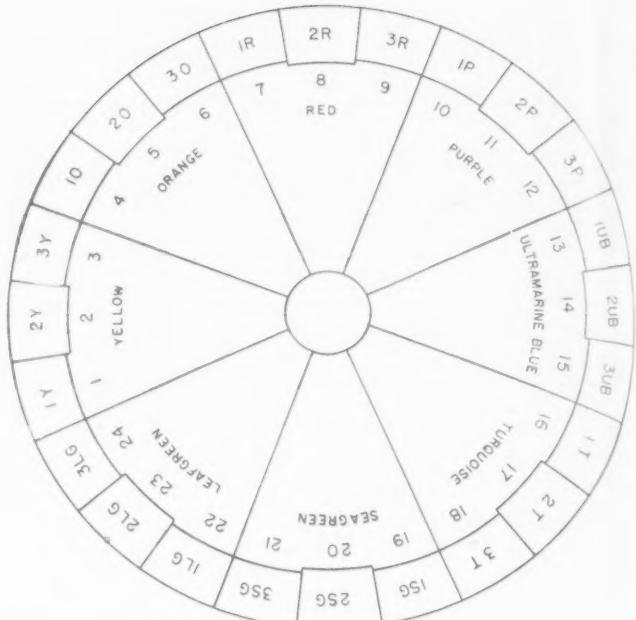
Ostwald System

Based on psychological principles, the Ostwald system differs considerably from the Munsell system which has its basis in the dominant wave length and reflectance characteristics of colors. In the Ostwald system, colors are classified as to hue and as to the relative amounts of black and white. The solid used in classifying colors under this system is in the form of a double cone with pure hues extending around the equator. Each of the 24 hues is designated by a number and the entire circle is divided into eight color groups of three hues as follows:

1: } Yellow	4: }	Orange	7: }	Red
2: }	5: }		8: }	
3: }	6: }		9: }	
10: }	13: }		16: }	
11: }	Purple		17: }	Ultramarine Blue
12: }			18: }	



Ostwald Color Solid. Pure hues extend about the equator. These form graded scales toward white, black and gray.



Ostwald Color Circle. The complete circle contains 24 hues, with the psychological primaries (red, yellow, sea green and ultramarine blue) as a basis.

16: }	Turquoise	19: }	Sea Green	22: }	Leaf Green
17: }		20: }		23: }	
18: }		21: }		24: }	

To further identify colors, the Ostwald gray scale is divided into eight steps designated as a, c, e, g, i, l, n and p, with a representing white and p representing black. Each color is then identified by a number and two letters, the number indicating the hue, the first letter showing the amount of white and the second letter the amount of black in the color. Thus, 8 pa, would indicate a red midway between orange and purple and with no black or white in the color mixture. A soft, grayish red, which was indicated as R 5/3 by the Munsell system, would be identified as 8 le by the Ostwald system.

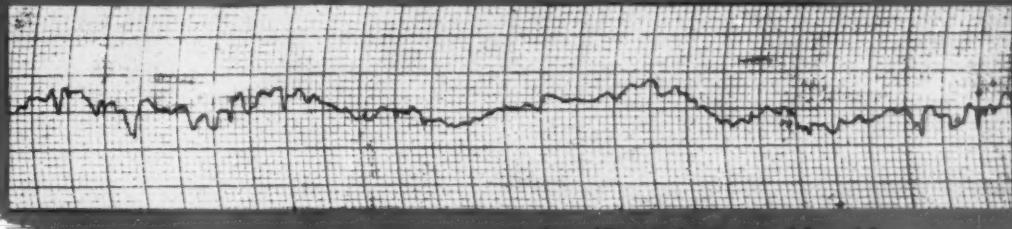
Chief value of these color systems is that they help to take confusion and misunderstanding out of color terminology and that they make possible the more exact specification of color. Each of the several hundred colors in each system is a carefully prepared standard to which other colors can be referred. Thus, when a manufacturer receives an order for certain products to be finished in a color identified by either the Munsell or the Ostwald system, he needs only to consult the proper standard to determine whether or not his finish is meeting the color specifications.

Comparing Colors

For making satisfactory color comparisons, the National Bureau of Standards recommends that the objects being compared be illuminated with equal amounts of the same quality light. The color standard and the object to be compared with it should be placed in the same plane so that diffused daylight (either standard artificial daylight or light from a north sky) strikes each equally at an angle of about 45 degrees. Both the standard and the object should be covered with a mask of medium gray paper in which two centrally located holes, two inches square, have been cut. These holes should be about one inch apart and one should be over the standard and one over the object to be compared with it. The colors should be compared by looking at them squarely rather than at an angle and mirror reflection of the light source should be avoided. It is also well to make the comparison under 100-watt gas-filled incandescent lamp strung at a distance of not more than four feet from the objects. This is an advisable practice as most household products are used under lamplight as well as in daylight and if careful comparison is not made the object may vary from the standard under the different light.

(Author's Note: Illustrations and much of the factual information for this article was obtained through the courtesy of General Printing Ink Corp.)

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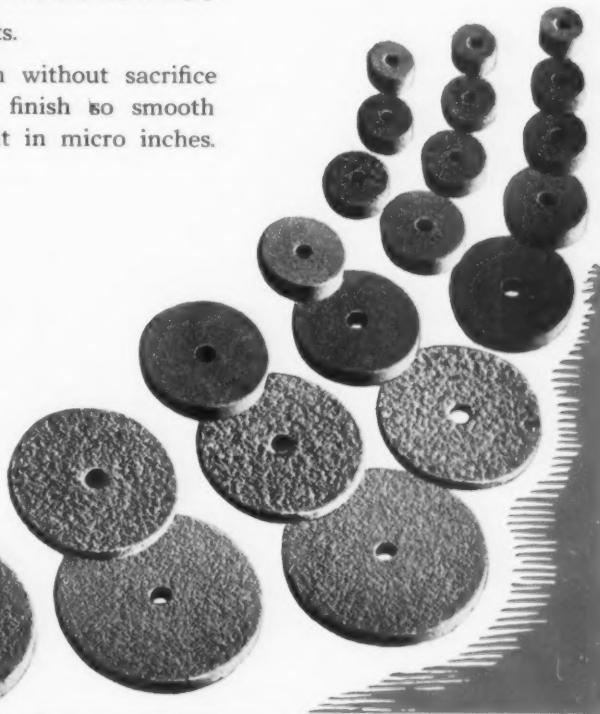
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Question. We have on hand a quantity of aluminum paste which we suspect contains some powder other than aluminum. Your advice will be appreciated as to what test or tests we may apply to determine the purity of the paste.

Answer. We assume the paste in question is made with mineral spirits or similar solvent. If this is the case, remove the solvent from a small quantity of the paste in a glass container by allowing it to dry in air or by heating over a water bath. (Caution. Keep away from open flames.) Add small amounts of hydrochloric acid to the dried paste, stirring constantly, until bubbling stops. (Caution. Use exhaust hood and keep away from open flames.) Then fill the container with acid and allow to stand overnight. Any appreciable quantity of adulterants will show as undissolved sludge on the bottom of the container.

Question. As part of our routine testing program we check all incoming drums of finishing materials for viscosity using an "efflux" type viscosity cup. Our cup, however, does not seem to work with one of the camouflage materials we began to use recently. The material flows out of the orifice until the cup is about two-thirds empty and then, after flowing intermittently for a few seconds, stops altogether. What can we do to overcome this difficulty? There appears to be nothing wrong with the material which sprays well and does a good job.

Answer. Certain finishing materials which possess high yield values act in the manner you describe. Flow starts through the orifice but ceases before the cup is empty when the height of material in the cup over the orifice drops to a certain point.

For the purpose of checking your incoming material, a special instrument may be obtained. You may, however, wish to continue to use your present viscosity cup. In that event, you may check indirectly by measuring the viscosity of a given amount of material to which a specified quantity of reducer (sufficient to produce a freely flowing mixture) has been added. Data thus obtained will be relative rather than absolute but will, we believe, serve the purpose. It is important to add the same quantity of reducer to the same amount of material from each drum being tested.

Question. We are sending you two perforated plates which have been dipped and which, you will observe, have a very heavy edge on the bottoms. These edges remain soft and when packed in tote boxes at the

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end of the baking oven tend to stick together and mar the finish. Thinning down the material reduces the heavy edge and drips but results in poor hiding at the tops of the pieces. Spraying does a better job but is somewhat slow for our purposes and does not give the mileage.

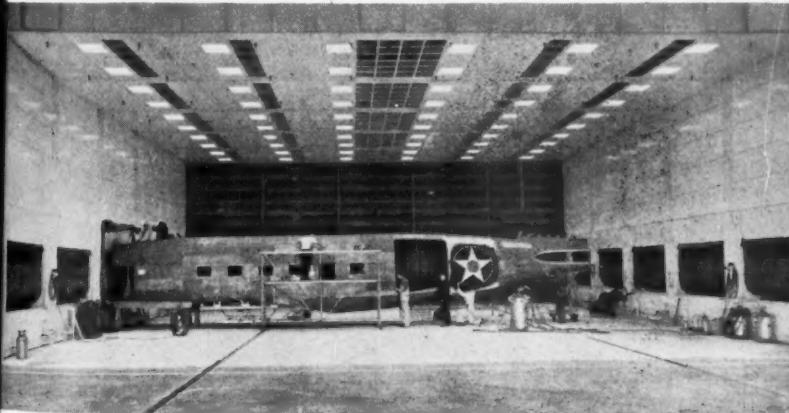
Answer. Better results will be achieved by hanging the plates from one of the corner perforations rather than from the center as

the samples indicate. By so doing, the last part of the plates to leave the material will be a corner and not the whole bottom edge and drips will be minimized. The use of a slower withdrawal rate — about one to two feet per minute depending on the viscosity of the material, its hiding power, etc. — will also help to reduce heavy edges and drips. Experimenting will show the combination of dipping speed and material viscosity which gives the best and fastest results.



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There are new spray painting techniques and equipment to keep finishing departments abreast of the whirlwind speeds being developed in America's great war industries. New products, made by new methods, are getting new finishes at speeds that were never heard of before the war. Both manual and automatic finishing has been stepped up to the vast scale of war production. As in peacetime, Binks Engineers have been prominent in these wartime developments. They have developed special equipment for finishing shells, bombs, tanks, jeeps and the vast amount of other equipment needed to win the war. The large manual finishing department shown above and the giant water wash spray booth shown below were both designed and equipped by Binks for one of the largest aircraft manufacturers in the country. There is a Binks Engineer in your territory now. He will be glad to show you how to keep your finishing abreast of new production speeds.



Manufacturers' Literature

Bakelite Resin Baking Coatings

Bakelite Resin Baking Coatings is the title of a new booklet recently published by the Bakelite Corporation, 300 Madison Ave., New York 17, N. Y. This is a 28-page illustrated booklet containing specific inform-

ation on the properties and characteristics of phenolic resin baking coatings. It includes technical information on the types of surfaces which can be coated with these finishes, methods of application, baking methods and equipment, the properties of Bakelite resin baking finishes and a list of tested and approved applications.

Tectyl Bulletin

This subject is running around in the minds of many chiefs of metal finishing. There seems to be no good reason why the

lessons learned in fighting corrosion to make certain that Government material arrives overseas in usable condition should not be applied to Industry's problems for post-war civilian needs. The trouble has been that rust has been taken for granted. That means that the labor of removing the rust has also been taken for granted. Chances are that it would be cheaper in the first place to prevent the rust. Firms writing on their letterhead to *Valvoline Oil Company*, Dept. OF, 470 Culvert Street, Cincinnati, Ohio may receive the *Tectyl* bulletin which discusses the product which has given the United States Navy and many contracting plants working for the Navy such real rust protection for the past several years.

Triple-A Protective Coatings

Quigley Company, Inc., 527 Fifth Ave., New York 17, N. Y., has issued a series of folders on its industrial paints (No. 377), marine coatings (No. 378), mill and dairy whites (No. 379) and aluminum coatings (No. 380). Each folder contains specific information on characteristics of the coatings, uses and conditions of application. The Company has also issued a six-page folder giving general information on its various lines of finishing materials. This folder contains a complete series of color chips.

Oven Bulletin

A new 12-page bulletin, No. 4T, titled *Heat Treating Ovens* has been published by *Young Brothers Company*, Detroit 7, Mich. Cabinet ovens, stationary and rotary shelf types, intermittent and continuous conveyor ovens and others are illustrated and described. A number of illustrations of other baking and drying ovens is also included.

New Book

Protective and Decorative Coatings, Volume IV, Joseph J. Mattiello, Ph.D., Editor-in-Chief. John Wiley & Sons, Inc., New York, N. Y. Price \$5.00.

This is the fourth of a series of five volumes on various phases of organic finishing and finishing materials, prepared by a staff of specialists under the editorship of the ab'e Dr. Mattiello. Titled Special Studies, this volume covers information of use and interest to both manufacturers and users of finishing materials.

The book contains twelve well and clearly written chapters on wetting, grinding, color, consistency, hiding, adhesion, permeability and film structure, livering microscopy, vacuum technology, emulsions and ultraviolet absorption of drying oils. For users of finishing materials the chapters on color, consistency, hiding and adhesion are recommended, particularly the last mentioned which is one of the best ever written and published.

Each chapter contains a valuable list of references and the book concludes with an excellently chosen 13-page index.

Special Studies deserves an important place along with its companion volumes in every library in the finishing industry.

ALKYD RESIN FINISHES

By GEORGIA LEFFINGWELL, Ph.D. and MILTON A. LESSER, B.Sc.

ONE of the important developments in metal finishing promises to be the wider use of alkyd resins. As glycerine, one of the chief ingredients of these resins, becomes more available, we can expect to apply in a larger field the lessons learned in providing protective coatings for our war equipment.

Alkyd resins, often referred to as glyceryl-phthalate types, have been in general use for some years.^{1, 2} Today the story of how these alkyds rose to the emergency is one of the industrial sagas of the war.^{3, 4, 5} They are employed in the lustreless olive drab enamels which the army is using on much of its equipment.⁶ They are specified by the Navy for the camouflage finish for sea-going vessels.⁷ Similarly, glycerine-phthalate resins have found extensive use in aircraft finishes.⁸ This equipment now has been in service long enough to prove that for durability and performance, as well as application characteristics, these resins are among the most effective coatings we know.

Government figures¹⁰ show that in 1943 about 52½ million pounds of glycerine were used in the manufacture of synthetic resins — far more than went into the manufacture of explosives or any other product that year. About 26½ million pounds of glycerine were used to make one class of resin-glyceryl phthalate alkyds.¹¹ Predictions are that similar substantial quantities of glycerine will be used in resin manufacture during 1944.

Chemistry of Alkyd Resins

Chemically, alkyd resins are the reaction products of polyhydric alcohols and polybasic acids, of which glycerine and phthalic anhydride are the prototypes. As remarked by Hovey and Hodges,¹² although literally thousands of alkyds have been described in the literature, relatively few of these compositions depart far from the use of glycerine and phthalic anhydride. Other alcohols may be used but, according to Martin,¹³ glycerine with its three hydroxyl groups provides a chance for more cross linkages and the formation of molecules of greater complexity, durability and drying rate. As a rule, phthalic anhydride because of its ease of reaction, cheapness and availability is preferred to such acids as maleic, succinic and tartaric.

Though sometimes used as such, alkyd resins are usually modified to meet specific requirements by the use of oils, fatty acids, natural resins, synthetic resins and certain other substances. By judicious selection of basic materials and modifying agents, it is possible to produce resins that have the requisite characteristics to do specific jobs.

Alkyd resins possess many advantages. They have toughness, flexibility and color-retentiveness. They can withstand high baking temperatures and are adaptable to

practically every phase of coating and finishing where protection from wear, tear and the elements is required.¹⁴

History

A study of the role of alkyds in protective coatings is, in a sense, a review of the development of modern finishes for metals. The story begins with their adaptation for use in automobile finishes.¹⁵ Early automobile lacquers were not entirely satisfactory. Many coats, with intermittent drying, were required to build a satisfactory thickness. In the search for resins compatible with nitrocellulose which would have sufficient weather resistance, gloss, flow, depth and other characteristics, chemists tried the alkyds and found they filled the bill. The use of these "lacquer type alkyd resins" resulted in the high speed, durable finishes we see today. Improvements in such automobile finishes are still being made.¹⁶

According to Sanderson,¹⁵ other alkyd resins have effected some important changes in the paint industry, not because of any single characteristic, but because of a combination of drying speed, durability, adhesion and resistance to discoloration. Such resins find almost innumerable uses. Baking enamels based on alkyds are now being employed in automobile finishes. Alkyds are used also as binders in fast baking pigmented undercoats applied to automobile bodies prior to the finishing coat.

Properties and Uses

Because they meet such requirements as resistance to discoloration plus ability to withstand water, grease, abrasion and impact, alkyd resins began to find extensive use in finishing metal refrigerator cabinets. Satisfactory results here soon extended the alkyds to finishes for other cabinets and metalware. Similarly, baked alkyd resin enamels found growing use on tinware and other sheet metals to obtain the combination of toughness, disotensibility and adhesion required to stand pressure drawing and forming operations.

In 1939, at the New York World's Fair, alkyd resins were given one of their severest tests. Used to cover the copper on the exterior of the General Electric Building, the protective coating helped the metal to retain its brilliant luster and characteristic color instead of turning green or showing brown spots through exposure.¹⁷

For many years the alkyds have found use in primers for metal finishes. Some time ago, Ellis¹⁸ pointed out that the tendency of cellulose lacquers to crack away from metallic surfaces was successfully overcome by the use of a primer of a glyceryl-phthalate resin. Many advantages have since accrued from its use for such purposes. Indeed, one finds alkyds regularly specified in the formulation of more recently patented



An alkyd resin in lump form used in making organic finishing materials.

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ed coating compositions suitable for primers for enamels and lacquers.^{19, 20}

Alkyds are also used in bases for incorporating zinc chromate or zinc yellow in primers for steel. Several investigations^{21, 22} have proved their suitability for this purpose. These resins are used also in the corrosion inhibiting primer for the aluminum and aluminum alloys used in aeroplane construction.^{15, 23}

This, of course, calls attention to the role played by alkyd resins in the formulation of anticorrosion paints. These paints form hard, elastic coats that are resistant to moisture and certain chemical influences.²⁴ In Europe, Heberling²⁵ stated that alkyd resins compatible with basic pigments are recommended for rust-preventing paints, such as alkyd resins plus red lead for the ground coating; and alkyd resins plus white lead, or zinc white, or white lead-zinc, for the finishing coating. He also noted that alkyd resin binders show a favorable action with basic pigments.

Other studies²⁶ covering the use of chromates as rust-preventive pigments showed that, in general, these pigments are more effective in alkyd resins than in linseed oil paints. The order of effectiveness in alkyd resins was found to be zinc yellow, chrome yellow, chrome orange and molybdate red. In mixtures of alkyd resins and linseed oil, the order of effectiveness was zinc yellow, molybdate red, monoclinic chrome yellow, chrome orange and rhombic chrome yellow. These verdicts were based on five-year exposure tests.

Alkyds are recommended also for coatings to prevent tarnishing. In one fairly recent patent formula²⁷ such a coating for silver or brass is made as a lacquer containing a castor oil-modified phthalic glyceride resin and a melamine-formaldehyde resin. In the anti-tarnish treatment with this lacquer the coated metal is heated to about 150°C. until a hard, clear coating is obtained.

The protective action of the alkyd resins has been applied not only to metal sheet, but to wire as well. Recent patents describe the use of such resins in compositions for making flexible, tightly adhering coatings on copper wire²⁸ and in insulating enamels suitable for use on wires.²⁹

In addition to their use as a major resinous ingredient of newer enamels,^{30, 31} the alkyds have found extensive use in conjunction with other synthetic resins. One development has been the combination of alkyds with urea-formaldehyde resins to yield useful industrial finishes.^{32, 33} Studied extensively by Hodgins and Hovey,^{34, 35} these vehicles are becoming widely used for formulating enamels, not only the white baking enamels for refrigerators, hospital equipment, metal equipment, metal kitchen cabinets and the like, but also colored enamels, on account of the short baking period necessary to obtain extreme hardness, marproofness and lightfastness. Newer coating compositions, based on such combinations, appear frequently in the patent literature.^{36, 37}

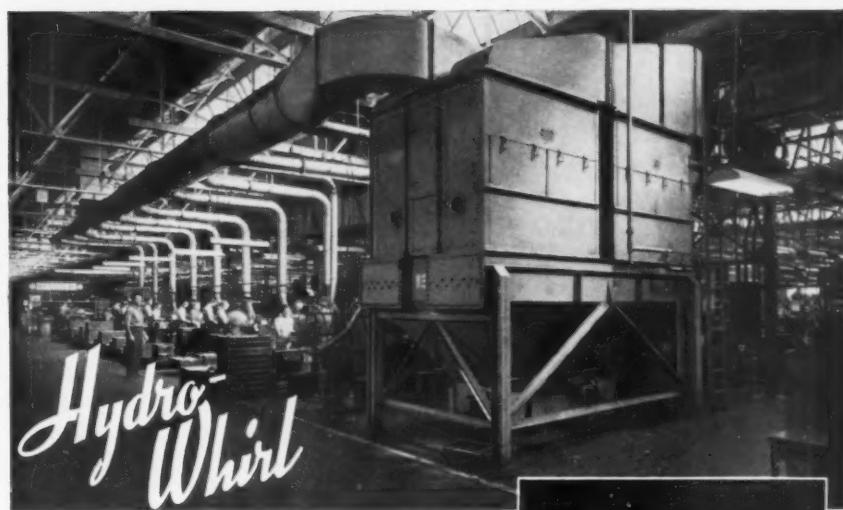
A somewhat later, but perhaps equally significant, development is the use of alkyds in conjunction with melaminealdehyde resins.³⁸ According to Pearce,⁴ the commercial development of the melamine-formaldehyde resins represents an important ad-

ance in the formulation of baking finishes. They are used with alkyd resins to provide rapid curing finishes of superior color and gloss retention.

The foregoing is but an indicative review of what is really an extensive field with many more potentialities in the field of metal finishing. It is certain that industrial finishers will look more and more toward the glycerine-utilizing alkyd resins for products with superior qualities and improved characteristics. As Glaser³⁹ has recently remarked, "Alkyd resins provide the paint formulator with an excellent and most versatile group of tools with which to prepare suitable finishes for wartime and for peacetime as well."

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MFRS. HYDRO-WHIRL DUST COLLECTORS AND SPRAY BOOTHES—INDUSTRIAL OVENS, MECHANICAL WASHERS AND VENTILATING SYSTEMS

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Fire Fighting Film

Because of the unprecedented demand for its motion picture "Flame Facts," Walter Kidde & Company, Dept. OF, 40 E. 34th St., New York 16, N. Y., have retained Princeton Film Center as distributing agents. This 20-minute, 16 mm. Kodachrome sound film shows how and why fire burns, the appropriate extinguisher for each type of blaze, and its correct use.

The number of requests for this film, together with wartime limitations on prints, have necessitated restricting bookings to those arranged by industrial plants, public utilities and other groups directly concerned with first aid fire fighting.

Eligible groups who wish to obtain "Flame Facts" may apply to Princeton Film Center, Princeton, New Jersey, for bookings at a small charge to cover handling costs.

NEW EQUIPMENT AND SUPPLIES



Infra-Red Baking

How installation of "dual-heat" infra-red equipment built by Jensen Specialties, Inc., Dept. OF, Detroit, Mich., has reduced paint drying operations on 600-pound Commander's Vision Cupolas from days to one-half hour has been told by J. M. Reynar, engineer of Westfield Manufacturing Company, River Rouge, Michigan. The cupolas are placed on tank turrets to give the commander a full view in any direction from within the tank.

The time-saving made possible by the Jensen installation is described by Mr. Reynar as follows:

"The assemblies are washed free of grease by a solvent process, then dried by a 5-minute pass through the Jensen Oven. Next they are spray coated with primer and cured 10 minutes in the oven. Finally they are sprayed outside with the familiar lusterless olive-drab coating and inside with a pure white lacquer and given a last pass through the oven of 15 minutes."

"This," says Mr. Reynar, "cuts the former painting time of several days to approximately one-half hour."

Developed by Jensen research, "Dual-Heat" efficiently combines radiant energy heat (heat transferred through radiant energy waves) with convection heat (heat transferred by means of air or gas currents) and gives, simultaneously, the benefits of both. It is made possible by the unusual design of the Jensen doubly-enclosed oven which locks in all the heat generated through radiation and thus gives more heat in less time.

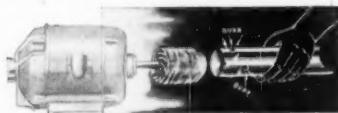
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The Harco abrasive cone is the fastest most economical method for all internal deburring, grinding, finishing and lapping or chamfering the edges of holes from $\frac{1}{4}$ inch to 8 inches or larger.



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The Harco abrasive cone is a flexible abrasive device which exerts equal pressure at all points in cylinders or tubes, grinding, finishing and deburring evenly. Extremely efficient where slotted abrasive discs are now used. Speed tested at 50,000 R.P.M. Made in 24 sizes and in grits from 24 to 320. In aluminum oxide grain. Approved and used by leading manufacturers everywhere. Nationally advertised.

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HARCO PRODUCTS COMPANY

GENERAL SALES OFFICES

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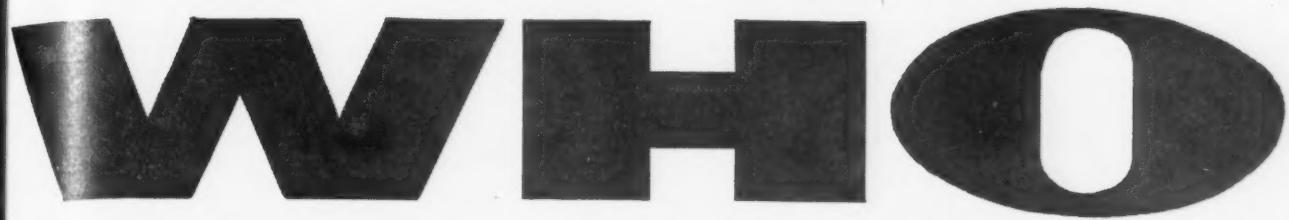
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2. More Economical
3. Less Odor
4. No Base Metal Attack

Send samples for stripping in our laboratory without obligation.

Consult us on your metal finishing problems.

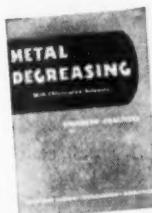
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WATERBURY 89, CONN.



USES VAPOR DEGREASING*?

Nearly everyone, today, who fabricates metal parts uses vapor degreasing. Because, by utilizing the chemical and physical properties of Trichloroethylene or Perchlorethylene, and scientifically designed equipment, this process rapidly and efficiently removes all grease and oil from metal parts. It saves precious time, needless cost. And it helps keep production flowing.

Thus vapor degreasing has played a mighty part in war production. Tomorrow, it will be an equally valuable tool for faster fabrication of better peace-time products. For, in good cleaning practice, vapor degreasing is *basic*.



"METAL DEGREASING—STANDARD PRACTICES"

This new booklet, prepared by Du Pont in consultation with equipment manufacturers, outlines the fundamentals of safe and efficient operation of vapor degreasing machines. Copies on request.

BE INFLATION WISE! Don't pay more than ceiling prices!

Don't buy on the black market! KEEP PRICES DOWN!



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...THROUGH CHEMISTRY

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Electrochemicals Department

Wilmington 98, Delaware

THIS METHOD...

1. **Thoroughly removes grease** and oil from metal parts of any size or shape, usually in a minute or so.
2. **Produces parts clean, warm and dry**—ready for inspection, assembly, further fabrication or finishing of any type.
3. **Minimizes finishing rejects** because solvent reaches and removes grease and oil from deep draws, holes and places which are almost inaccessible.
4. **Reduces risk of damage to delicate parts.**
5. **Can be used alone** or as a part of a process flow line.
6. **Utilizes compact equipment** that fits into small space.
7. **Consumes** only small quantities of solvent. Contaminated solvent is recovered economically for re-use.
8. **Uses** the absolutely pure vapors of a non-flammable solvent as a cleaning medium.
9. **Simplifies** cleaning procedure, is easy to operate as a process.
10. **Saves time and cost**—in its own operation, and in the subsequent handling and finishing of parts.

*Vapor degreasing is basic for good metal cleaning. For each job there is a suitable cycle or combination of treatments. In every case, the final rinse in pure, uncontaminated solvent vapor assures positive removal of the last traces of grease and oil.

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 SIGNAL**
*FOR
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One of our wartime advancements has been the development of phosphate coatings for ferrous metal surfaces to provide increased corrosion resistance in conjunction with paint finishes. The Preprite phosphate coating process has received wide acceptance for military requirements and has proved itself to be thoroughly effective. It has resulted in considerable saving in time, labor, space and over-all cost due to its simplicity and fewer number of steps required. This process should be of interest to refrigerator manufacturers, auto body manufacturers, venetian blind manufacturers, office furniture manufacturers, water cooler manufacturers, deep freeze unit manufacturers and many others. WRITE FOR LITERATURE.

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for general treating of rust removal and metal treating before painting:

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 ALUMIPREP . . . PREP-PIK-L**

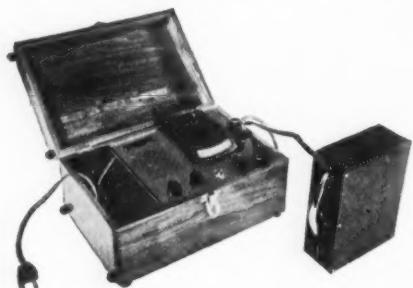
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PHOTOVOLT Photoelectric Glossmeter



For measuring the gloss of paint and varnish finishes according to

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- Infra-Red Reflection Tests
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- Smoothness of Metal Finishes

Portable, rugged, simple in operation.

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Heat Resisting Paint

Quigley Company Inc., Dept. OF, 155 Fifth Ave., New York 17, N. Y., has announced the development of Triple-A heat resisting paint. Applied as received without thinning, this material requires no air drying for interior use where moisture conditions are normal. For interior use where extremely wet conditions prevail, it is necessary to heat the film to at least 300° F. When used on exterior surfaces, a heat up to 500° F. is required and may be obtained with a blow torch, acetylene burner or infrared lamps. For continuously hot surfaces which reach 212° F. or above, no heat treatment of the film is necessary.

The resistance of the material to heat depends on the surface to which it is applied. On light steel it will adhere under normal heating and cooling up to 1400° F. On alloy steel, brick, etc. it will stand 250° F. or over. It is non-flammable, non-irritating and does not give off fumes or odors when being applied, upon drying or when subjected to heat or flame.

Paint Stripper

A "non-creeping" liquid that quickly strips finishes from metal has been developed by Fidelity Chemical Products Corporation, Dept. OF, 430 Riverside Ave., Newark 4, N. J. The liquid, marketed as Fidelity Stripper No. 306, was developed especially for rapid removal of insulating coatings from wires and baked enamels from objects which cannot or should not be stripped.

The stripper is applied by brush at room temperature and, usually in less than a minute, causes the finish to puff and leave the metal. The metal is then wiped clean and since there is no residue or corrosive action the stripped part may be soldered or refinished without any after treatment, according to the manufacturer. The liquid does not run, so that stripping may be limited to specific section of coated surface.

Phen-Cote

"Phen-Cote" is one of a new series of developments in the field of organic surface finishes. It is a true thermo-setting plastic that is converted in a short baking cycle to an extremely hard yet flexible film that is highly resistant to acids, alkalies, oils, greases, alcohol, solvents and most chemicals. A product of the Watson-Standard Company, Dept. OF, 225 Galveston Ave., Pittsburgh, Pa.

Phen-Cote is adapted to hand or automatic spraying or can be dipped or roller coated and forms a continuous, homogeneous film. This finish contains no oil modifier nor plasticizers which have a tendency to dilute or weaken the film in its resistance. It therefore produces a hard, indestructible, insoluble, flexible film. Phen-Cote has many applications and adaptations to specialized job conditions and is readily adapted to producing linings for sanitary food cans to contain fish, meats and other edible products requiring a lining having excellent oil resistance. As an exterior protective coating, this product will fabricate process and produce superior corrosion resistance on black iron plate, electrolytic and hot dipped tin plates.

Tectyl stops RUST!

30,000 Gallons for Pearl Harbor
—that was the government's
order on DECEMBER 8, 1941

Government salvage experts know what Tectyl 511 has done on metal surfaces that have been submerged in sea water. Tectyl removes every vestige of water and SEALS the surface against rust and corrosion. Whatever your own special rust-prevention problem may be, there's a Tectyl product that will solve it and save you money and man-hours. Easy to apply and remove, economical to use. Tectyl protection is positive. Write NOW, indicating your corrosion problem, and we will send you Tectyl bulletin with complete application data.

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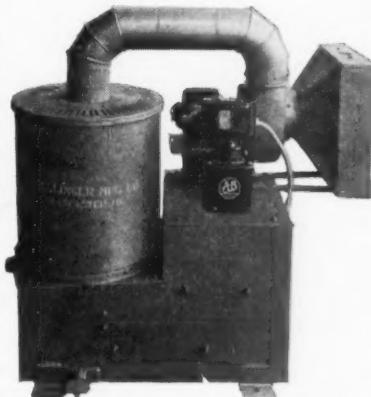
Dries the
average basket
of small parts
in less than 35 seconds!

The Kreider Centrifugal Dryer is a modern drying machine . . . designed for speedy production . . . engineered for easy operation and low operating costs.

This all-steel electric welded dryer is ruggedly constructed. It has V-belt drive, reversing drum switch, fast-acting foot brake, $\frac{3}{4}$ H. P. motor for efficient, economical operation. Available with or without auxiliary heating unit.

Write or wire for complete information and prices.

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DIP + AGITATION = better batch cleaning of metal parts

The OPTIMUS Dip-Agitating Type Portable Washing Machine is ideal for cleaning, washing, paint stripping, anti-rusting, rust-proofing, rinsing, chemical treatments, coating, etc., wherever production, maintenance, or repair needs do not require a spray type machine.

To the soaking action in the cleaning solution is added a strong mechanical agitating action. The vertical up and down dipping motion of the load in and out of the liquid is effective in many cases in speeding up the cleaning operation, reducing time involved by as much as 50% to 75%.

Advantages

- Can handle any parts, in baskets on racks, or individually
- Can be used with any cleaning agent (alkaline, solvent emulsion, straight solvent)
- Easy handling of parts
- Fast cleaning
- Can be heated by any means
- Less wearing parts
- Portable, easily moved
- Agitation costs less than 2¢ per hour

OPTIMUS Spray-Type Machine

A spray washing machine of similar arrangement and portability, for the cleaning of relatively small series of large, heavy, parts in process of fabrication, or before, and during, maintenance and repair. Especially suited for handling of diesel, auto and airplane engines, compressors, pumps, motors, etc. Also, smaller parts in baskets, or on racks.

SEND FOR your copy of new Bulletin 4E2 "Batch Cleaning in Portable Metal Washing Machines". Bulletin 4E1 describing other "OPTIMUS Machines For Every Metal Washing, Cleaning and Drying Problem" also available.



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Engineers and Manufacturers of
Washing, Rinsing, Pickling and
Drying Equipment for Metal Parts

Business Items

Clarence M. Brown, Philadelphia attorney, has been recalled as chairman of the Pittsburgh Plate Glass Company, Pittsburgh, Pa., to fill the post left vacant August 13 by the sudden death of H. S. Wherrett.

Leland Hazard, general counsel, was elected vice-president, H. B. Higgins, president, was named chairman of the executive committee and H. B. Brown, secretary, was elected to the Board.

J. M. Bowlby, president of The Eagle-Picher Lead Company, Cincinnati, Ohio, has announced the retirement of George W. Potter, director, executive vice-president and general manager of the Company's subsidiary, The Eagle-Picher Mining and Smelting Company; and of G. C. Niday, Tri-State manager of Mines and Mills. Messrs. Potter and Niday are retiring to devote their attention to other non-competitive personal interests in which they have been associated for many years.

At a regular meeting of the Board of Directors of The Eagle-Picher Mining and Smelting Company, Mr. Bowlby was designated general manager, in addition to his present duties as president. He will be assisted in the direction of the Company's activities by Messrs. D. C. MacKallor, Hamilton A. Gray and Elmer Isern, who have long been associated with the Company in executive capacities. At the Board meeting, Mr. MacKallor was elected a director and Messrs. MacKallor, Gray and Isern were elected vice-presidents.

Mr. Bowlby also announced appointment of R. L. Hallows as technical assistant to the president of The Eagle-Picher Lead Company and production manager of the Pigment Division of that Company. Mr. Hallows' most recent assignment was as superintendent of smelters of the subsidiary.

An important reduction in the cost of lacquer applications has been made in the

laboratories of the *Hercules Powder Company*, Wilmington, Del., according to a paper given by William Koch before the Division of Paint, Varnish and Plastics Chemistry at a meeting of the *American Chemical Society* in New York City.

The reduction in cost is obtained through a saving in solvent and a reduction in the number of finishing coats required without sacrificing the recognized high quality performance of nitrocellulose lacquers. The saving in solvent and the reduction in the number of finishing coats is a result of using nitrocellulose lacquers of increased solids content at spraying viscosity, according to Mr. Koch's report.

Data were presented which demonstrated that the solids content in nitrocellulose lacquers can be increased by using lower viscosity type nitrocelluloses and larger proportions of nonoxidizing alkyd resins with either a more active solvent or by applying the lacquer by a hot spray method.

The results obtained by using each method were cumulative when two or more were used at the same time. The greatest increase in solids content is possible only when two or more methods are used.

Four nitrocelluloses of standard types well known to the trade were used in the tests. Percentage increase in solids content ranged as high as 114 per cent in one instance. This was accomplished through a combination of the four methods of increasing the solids content.

Nitrocellulose lacquers have been widely used for many years because of properties such as rapid drying to a hard film without the necessity of baking, good resistance to temperature change, hardness which makes lacquers resistant to scuffing and printing, ease of finishing, and formation of pleasing and weather-resistant films.

The new methods of increasing the solids content are expected to further enhance the value of using nitrocellulose lacquers in industries such as automobile and furniture. This new development may also become important in the coating of cloth and paper.

Patents

Drying Helmets

U. S. Pat. 2,355,459. W. J. Miskell, Aug. 8, 1944. An army helmet pretreatment comprising means for conveying army helmets in endless succession through a treatment zone, means for rotating said helmet while within said zone, a battery of infrared lamps located within said zone in position adjacent to said helmet rims, and reflecting means to concentrate the radiant energy from said lamps upon the rims of said helmets passing through said zone.

Protective Coating

U. S. Pat. 2,355,889. J. J. O'Loughlin, assignor to Paint Engineers, Inc., Aug. 1, 1944. A method of producing protective coatings which comprises dissolving chromic acid in water then adding the water solution to ethylene glycol monoethyl ether, room temperature to control the reaction same, and incorporating the resulting product in a protective coating vehicle.

Varnish

U. S. Pat. 2,356,789. M. Holzmer and T. A. Neuhaus, assignors to The Glidden Co., Aug. 29, 1944. A mixing varnish consisting essentially of a solution of an unmodified heat-hardenable phenol-formaldehyde resin and a resin selected from the class of methyl and ethyl abietates in a mutual solvent comprising a phenol.

Lacquer Polish

U. S. Pat. 2,356,792. B. J. Oakes and D. K. Murray, assignors to Minnesota Mining & Mfg. Co., Aug. 29, 1944. As a new composition of matter, a viscous liquid abrasive polish, adapted for use in polishing lacquered and enameled surfaces, comprising an oil-in-water emulsion having finely divided feldspar abrasive particles suspended therein, said oil-in-water emulsion comprising volatile mineral oil as the dispersed phase and water as the continuous phase, with said mineral oil present in proportion by weight at least approximately three times that of said water; a water-soluble emulsifying agent present in substantial but minor proportion to said water, and said abrasive particles being present in greater proportion by weight than the aggregate of the liquid constituents of said polish.

Clear Coating

U. S. Pat. 2,357,458. J. W. Clough, assignor to E. I. duPont de Nemours & Co., Sept. 5, 1944. An improved substantially clear coating composition particularly adapted for finishing bowling pins and the like, comprising a cellulose derivative selected from the group consisting of cellulose esters and cellulose ethers and an anti-dirt collecting agent consisting of a halide of an aliphatic long chain derivative of a heterocyclic nitrogen base in which the aliphatic radical is linked directly with the nitrogen atom, said composition being substantially resin-free.

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Important! in YOUR POSTWAR Planning

IN this valuable folder are described new, efficient methods of thorough-cleaning metal parts and products for quality control, fewer rejections and lower production costs. Contains many distinct innovations arising from war-emergency "Quality Control" inspections. In your postwar planning it will pay you to investigate the advantages that standard A-F Cleaning and Finishing Equipment—or custom-built A-F Equipment—will give your plant. Send for this interesting folder—TODAY.

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ODDS and ENDS

Geography Dept:

We've reserved a place on the map for all correspondents who ask us to send them, by return mail, complete details on *all* commercial electroplating solutions, including formulas and operating conditions. Also, post-war prospects, since they know *nothing* about plating, except that they would like to enter the field. The place is in the vicinity of Mokmer airfield on Biak Island in Geelvink Bay, about 120 miles east of Manokwari, where they can relax comfortably while waiting for the requested information.

Since we were ushered into the Fourth Estate through a side gate we have learned to expect either questions or complaints from our correspondents. It is, therefore, a red letter day in our department when we receive a note of thanks from a subscriber, informing us that the technical information furnished was just what he was looking for. Such letters arrive just often enough to enable us to look the boss in the eye when pay day comes around.

Washingtonia:

John J. Bognar has resigned from the War Production Board, according to George Grupp, our Washington correspondent, in the last issue of *Metal Finishing*. He probably got tired of picking up the receiver and hearing: "Is this the Chief of the Finishing and Treating Section, Repair Shops Branch, Service Equipment Division, Consumers' Hard Goods Bureau of the War Production Board?"

Incidentally, what are Hard Goods?

It's Done With Mirrors:

A contemporary, describing a method for removing tin from bottle caps, using chlorine gas, states that ". . . it will be found that the metallic tin has been converted to sodium stannate."

In a recent review, the *Nickel Bulletin* mentions plating tanks having an ammeter and voltmeter to indicate *operating efficiency*. Our meters only indicate *volts* and *amperes*!

From *Popular Science Monthly*: "Washed with high pressure sand blasting." No soap??

Honest error is to be pitied, not ridiculed.—Chesterfield.

For the Platerettes:

If a woman did what an efficiency expert or an expeditor did, they'd call it nagging.

Live and Learn:

Now that we've gone back to red pennies (or should we have said cents?), the censor will probably have no objection to our passing along the information that electroplated sheet was used for the zinc coated steel pennies because hot galvanized sheets caused the dies to clog.

Tests have shown that vapor degreasing and alkaline cleaning, as pretreatments for phosphating, give different thicknesses of phosphate coatings.

Beryllium is not considered a precious metal while silver is. The cost of the former, however, is \$17 per pound while silver is worth less than \$8 per pound. And we've been informed that, in London, pipe tobacco is worth more than silver too.

Keeping the Home Fires Burning:

A. C. Scavullo, who recently was granted a patent on a plated kitchen utensil, assigned the patent to V. K. Scavullo, F. Scavullo, C. Scavullo, M. Scavullo Seagert and M. Scavullo Scott. It's sliced pretty thin, but it's still in the family!

Slogan of the Month:

Back the Attack with your Jack—Buy War Bonds!

WHERE DIMENSIONAL CHANGE IS *out*

THE BULLARD-DUNN PROCESS IS *in*

NOTE THESE OTHER ADVANTAGES

- ★ Fast
- ★ Economical
- ★ Labor saving
- ★ Easy to operate
- ★ Long Solution life
- ★ Produces chemically clean surfaces
- ★ No etching

BULLARD-DUNN
Process

DIVISION OF THE
THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

Among the reasons for the widespread use of the Bullard-Dunn Process in plants which descale gears, dies and precision threaded parts is the fact that it does not attack the base metal. Also, by its high "throwing power" it removes scale completely from tiny recesses and internal surfaces.

These unique advantages, coupled with its greater speed, make the Bullard-Dunn Process indispensable for production where time is at a premium and accurate work a necessity. Send samples of your work for an estimate. Write for booklet today.

File This Supply and Equipment List for Future Reference

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- ACID CROCKS
- ACID PITCHERS
- ACID PROOF APRONS
- ACID PROOF GLOVES
- ACID PROOF PAINT
- AGITATORS—Single and Double Cathode Rod
- AMMONIUM NITRATE
- ANODE BAGS—Cotton and Glass Cloth
- ANODE SCRAP SAVERS
- ANODES—For all plating solutions
- BALL ANODE CONTAINERS
- BARIUM CARBONATE
- BICARBONATE of SODA
- BORIC ACID
- BRIGHT NICKEL PLATING SOLUTIONS
- BRUSHES—Cotton Plate (Cotton Swabs)
- BUFFING COMPOUNDS
- BUFF RAKES
- BURNISHING and TUMBLING BALLS and BARRELS
- BURNISHING SOAP
- CARBONATE REMOVER
- CAUSTIC POTASH (Potassium Hydroxide)
- CAUSTIC SODA (Sodium Hydroxide)
- CENTRIFUGAL DRIERS
- CHROMIC ACID
- COPPER CARBONATE
- COPPER SULPHATE
- CYANIDE—Copper, Sodium, Zinc
- CYANIDE CHLORIDE MIXTURE 43/45%
- DARCO (Activated Carbon)
- DEGREASING MACHINES
- DIPPING BASKETS
- DOUBLE NICKEL SALTS (Nickel Ammonium Sulphate)
- EMERY PASTE
- FILTERS
- GLUE POTS
- GREASE STICK
- MAGNESIUM SULPHATE
- METEX METAL CLEANERS
- MOTOR GENERATORS—Low Voltage
- NICKEL CHLORIDE
- PERM-A-CLOR Degreasing Solvent
- PLATERS TAMPICO HAND BRUSHES
- PLATING BARRELS HORIZONTAL
- PLATING GENERATORS
- PLATING MACHINES—Full Automatic
- PLATING MACHINES—Semi Automatic
- PLATING RACKS
- PLATING TANKS
- POTASSIUM CARBONATE
- POTASSIUM CYANIDE
- PUMICE
- RECTOPLATERS
- RHEOSTATS
- ROTO FINISH COMPOUND
- ROTO FINISH DEBURRING CHIPS
- ROTO FINISH MACHINES
- SAL AMMONIAC (Ammonium Chloride)
- SAL SODA
- SINGLE NICKEL SALTS (Nickel Sulphate)
- SOAP CHIPS
- SODA ASH
- SODIUM ACETATE
- SODIUM STANNATE
- SODIUM SULPHATE
- STOP-OFF LACQUERS
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- TANKS—Plating, Anodizing, Cleaning and Rinsing
- TEMPERATURE CONTROLLERS
- TEST SETS
- TIN CRYSTALS (Stannous Chloride)
- TRIAD—Degreasing Solvent
- TRIPOLI COMPOSITIONS
- TRI SODIUM PHOSPHATE
- UDYBRITE (Cadmium Brightener)
- UDYLITE CADMIUM SALT #1 (Cadmium Oxide)
- UDYLITE CADMIUM SALT #2 (Cadmium Oxide)
- UDYLITE TEST SOLUTIONS
- VOLTMETERS
- WIRE SCRATCH BRUSHES
- WHALE OIL SOAP
- WHITE CHROMIUM COMPOSITION
- WHITE COLORING COMPOUND
- WHITE FINISH COMPOUND
- ZINC BRIGHTENER
- ZINC DUST
- ZINC OXIDE
- ZINC PLATING SALTS
- ZINC SULPHATE

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